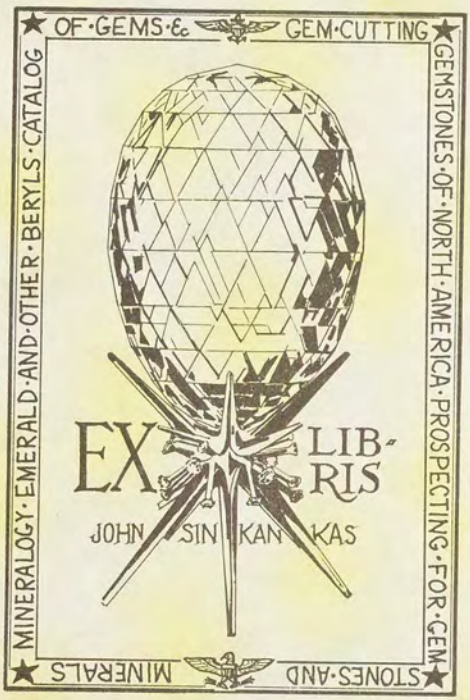


See second Pl.

Sr Isaac Newton
Pt —

FOSSILS

Of all KINDS,

DIGESTED into a

METHOD,

Suitable to their mutual

Relation and *Affinity*;

WITH

The NAMES by which they were known to the ANTIENTS, and those by which they are at this DAY known: And NOTES conducing to the setting forth the NATURAL HISTORY, and the main USES, of some of the most considerable of them.

AS ALSO

Several PAPERS tending to the further Advancement of the Knowledge of MINERALS, of the ORES of METALLS, and of all other SUBTERRANEOUS PRODUCTIONS.

By JOHN WOODWARD, M. D. late Professor of Physick at GRESHAM COLLEGE, Fellow of the College of PHYSICIANS, and the ROYAL SOCIETY.

LONDON:
Printed for WILLIAM INNYS, at the West-End of St. *Paul's*. M.DCC.XXVIII.

THE PREFACE,

Giving ſome Account of the great Plenty, Variety, and Excellence of the ſubterranean Productions and Riches of ENGLAND.

METALLS and Minerals are allow'd on all Hands, to be of that high Value, and of that Uſe in ſo many very important Parts of human Life and Affairs, that they merit, and juſtly challenge our utmoſt Study and Attention. The judicious and intelligent Part of Mankind want not a due Senſe of this, and that a great

Share of our Wealth and Strength, our Happineſs and Security both at Home and Abroad, depend very much upon them. That a Conſiderable Part of this Iſland, I mean Cornwall, *abounds in Tin, one of the moſt uſeful of them, has been known from the earlieſt Times. Nay, it has been a chief Branch of our Trade, one of our moſt profitable Manufactures, and for many Ages employ'd a multitude of Hands, to great Advantage for themſelves and the Nation, that would otherwiſe have been wholly idle, in Want and Diſtreſs. The Lead of* England *is another main Fund of our Riches. The Ore of it is not only found here in great Plenty, but 'tis kindly and well condition'd, melts and obeys the Fire, and yields the Metall in it with leſs Fuel, Trouble and Expence, than any of the Foreign Lead-Ores that I know. Then, when ſeparated, 'tis better, ſofter, more ductil, and fit for Uſe, than that of all other Countries. Which does not ariſe from any Peculiarity in the Metall; for the Lead of* England, *and that of* Saxony, *the Gold of* Japan, *and that of* Brazil, *the Silver*

of

of Peru, *and that of* Norway; *to be ſhort, all Metall of the ſame Kind, when reduc'd to an equal Purity, is alike in every Reſpect, in what Country ſoever it be got; but becauſe the Spar, and other extraneous Matter, incorporated with the* Engliſh *Lead in the Ore, happens to be of ſuch Nature and Diſpoſition as to be wrought upon eaſily, and freely to part from it. Nay, ſo much* Iron *and* Copper *hath been diſcovered of late Years, and ſo many Ways of working and extracting them newly found out, that we have now vaſt Quantities of our own to export and ſend Abroad, that were wont heretofore to import them at very conſiderable Charge. 'Tis but a few Years ſince* Wad *or* Black-Lead *was found out. Nor is there in all the whole Globe beſides, the like Plenty, or any of near the Goodneſs and Worth of ours. The ſame may be ſaid of the Coal that we have without Meaſure, and that is of ſuch indiſpenſible Uſe and Neceſſity in almoſt all our Affairs. Thoſe large Maſſes of good Load-Stone found on* Dartmoor, *the Antimony of* Cornwall, *the Manganeſe of* Mandip,

Mandip, *and the Calamin, finer and better than any in the World beſides, our Alum and Vitriol are further Inſtances of our Wealth under Ground. Many other Diſcoveries aſſuredly remain yet to be made, and Improvements in the Ways of working our ſubterraneau Productions, managing them to better Advantage, and turning them to further Uſes.* Multa egerunt qui ante nos fuerunt, ſed non peregerunt, multum adhuc reſtat operis, multumq; reſtabit, nec ulli nato poſt mille ſæcula præſcindetur occaſio aliquid adhuc adjiciendi, *Seneca. Thoſe who have either little Capacity, and Command of Thought, or have it, and make little Uſe of it, will not be eaſily brought to believe to how great Purpoſes Things ſeemingly very ſlight may be made ſerviceable. For the Preſent, I will inſtance only in* Fuller's-Earth; *which* England *affords ſo very good, and in Quantity ſuperior to that of any Country beſides. Thoſe who are not rightly acquainted with the Uſes of this, and ſhould only look into the Pits of it, that are at* Wooborn, *and in ſeveral other Parts of the Kingdom, would be*

apt

apt to ſlight and deſpiſe it; and very probably to laugh at any Man who ſhould take upon him to ſet forth how precious a Commodity it is; tho' in Truth, it be a Thing of much higher Advantage, and brings in a greater Revenue to this Crown and Kingdom, than the Delves of Diamonds *in* Golconda, *the* Silver Mines *of* Potoſi, *and the* Gold *of* Braſil, *bring into the* great Mogul, *the King of* Spain, *or* Portugal. *Thoſe ſerve rather to reduce and impoveriſh the People, by rendring them proud and haughty, and conſequently idle and vicious, than really to enrich and turn to their Benefit. Indeed their Neighbours wiſely take the Advantage of their Sloth and Negligence; and turn eaſily to their own Profit, what, want of Virtue and Induſtry in the original Proprietors let lye wholly unimployed and fruitleſs, while in their Hands. Our Anceſtors were well aware of how great Benefit to the Nation* Fullers Earth *muſt needs prove. One main Property of it is to imbibe Oil, Greaſe, and all other like unctious Matter: 'Tis that Property that renders this Earth ſo*

uſeful

useful in the cleansing Woollen Cloth, *and freeing it from all those noisome and offensive Impurities. Every Body conversant in rural Affairs, must needs know how frequently* Tar *is of Necessity imploy'd; as also Grease and Tallow, in the Diseases and Affections that Sheep are externally so frequently obnoxious to: And besides, their Wool cannot be work'd, spun, or wore into Cloth, unless it be first well oil'd and greas'd. Now, all this must be taken out of it again, before it can be worn or turn'd to Use. Nor has there been any Thing ever yet found out so serviceable to that End, as this Earth. And, as the* Fullers Earth *of* England *is got in great Plenty, so it very much exceeds any hitherto found out Abroad in Goodness. Which is the chief Reason why the* English *surpass all other Nations in the Woollen Manufacture; and to preserve the Benefit of this to the Country, and secure it from the Usurpation of Foreigners, the Exportation of* English Fullers-Earth *is strictly prohibited by* Act of Parliament.

What

What may ſerve further to incite our Diligence and Curioſity is, that ſome late Searches have ſhewn us many Things beſides thoſe already pointed forth, that were wont to be fetch'd from afar, nay in Plenty, and much greater Perfection, here at Home. We have Demonſtration of this in the many large ſtately Maſſes of the blackeſt and moſt polite Jeat, *diſcover'd ſo frequently on the Coaſts of* York-ſhire; *in the beautiful fine* Amber *of* Suffolk, *and our other Shores. Then we have* Jaſpers, Cornelians, Agats, Mochoes, *and* Onyxes; *as alſo* Topazes, *and* Amethyſts, *as fine, if not ſo hard, as the Oriental.* Diamonds *indeed we have none; nor Rubies, with ſome others of the Gemm-Kind. But, excepting theſe, and* Cinnabar, *I know not any Production of the Earth whatever, that I have not found in this our native Country; ſuch is the Præeminency of the Soil of* England! *ſuch its happy Fertility, and Abundance in all Kinds of ſubterranean Treaſure. Nor need we go far for Proof of this, when my own Cabinets have*

now actually in them (to pass by the Extraneous, *which are in as great Numbers) above* 2800 Native Englifh Foffils, *all different. So great a Number, got together by the Induftry of one fingle Man, involv'd all the while in Multiplicity of other Bufinefs, cannot furely but fhew that the Soil produces them in great Abundance. Which will be made much more apparent, whenever like Searches are undertaken in Earneft by one that has Leifure and Encouragement.*

But what crowns all is, a Man is here fure, when with great Charge, Labour, and Contrivance, he has once difcover'd and obtain'd any Kind of this Treafure, to hold and enjoy it. In other Countries, the greateft Share falls to the Lord of the Soil, or the Prince of the Country: And he that ftudies and drudges for it, enjoys the leaft Part of it. This is a cruel Check and Difcouragement to Search and Induftry! But happy England *is fecure, and wholly exempt from this; which is all owing to the Virtue and Wifdom of our Anceftors, and to the Excellence of thofe Laws,*

Laws, and that Conſtitution, which, at the Expenſe of ſo much Blood and Treaſure, they got eſtabliſh'd, and tranſmitted down intire to us their Poſterity. By which Means we continue a free People, while not only our Neighbours all round, but almoſt the whole World beſides, are under a Tyranny of one Sort or other; and ſubjected to the Luſt, Ambition, Avarice, and Oppreſſion of thoſe who ought to be Fathers of their Country, and protect them in their natural Rights. So ſacred a Tye, and high an Obligation do we, who are ſo ſenſible, and thorowly appriz'd of the Happineſs of theſe Laws, and the Excellence of this Conſtitution, lye under to guard both with the utmoſt Zeal, Vigilance, and even Jealouſy; to tranſmit them down intire and ſafe to our Poſterity: To be true to that great Truſt which our Forefathers have thus repoſed in us; and never part with, or give up any the leaſt Particle of this ſo fair and precious Jewel. If there be amongſt us any of ſo clumſy a Frame, and ſo thorowly hard-headed, that they cannot, or ſo corrupt and blinded by other Intereſts, or ſo

ſway'd and byaſs'd by wrong Maxims which they happen to be poſſeſs'd with, that they will not, be wrought upon by theſe Conſiderations, they cannot fail of being effectually convinc'd, if they pleaſe to look into what they will find ſet in a much better Light by Polybius, *by* Livy, *by* Tacitus: *Or, if they pleaſe to compare the Condition of the* Romans, *while a free State, with that, while under the continually incroaching Power of their Kings and Emperors; or of the* Athenians, *and the other* Grecian States, *while they were under the Protection and Encouragement of their own Laws, with that, when under their Conquerors: To obſerve their then Grandeur, their Riches, and that all the more elegant and uſeful* Arts *and* Sciences *had their firſt Riſe, and the* Muſes *their Seat there; and compare that with their preſent Condition, their Meanneſs, their Poverty, and even aſtoniſhing Ignorance, cannot ſurely heſitate one Moment in deciding to what it is that* Great Britain *owes all its Happineſs.*

Theſe

These things rightly weigh'd, with several others that might well be offer'd; had I not already too far transgress'd and exceeded my Bounds; and the many noble Products of England *duly reflected on, 'twill hardly be possible for a Man to withhold himself from falling into the same Transport and Passion for this Country, that one of the greatest Wits of* Italy, *in his Time,* Giovanni Cotta, *did for his.*

— Qui Te noverit
Et non amarit protinus
Amore perditissimo,
Is, credo, seipsum non amat;
Caretque amandi Sensibus,
Et omnes odit Gratias.

For those therefore that, thus taken with these so useful, instructive and delightful Studies, may, of their Virtue, Good Sense, and Love to their Country, be ambitious of facilitating them, and of inlarging, and further displaying this so beautiful and charming a Scene, I shall, from my little Store, pick out such loose scat-

ſcatter'd Papers *that, I judge, may contribute ſomething to their Light and Direction; delivering them in the Order that follows.*

NUMBER I. Foſſils digeſted into a Method with Notes.

NUMBER II. In quâ, uno intuitu, conſpiciuntur omnis Generis Foſſilia, juxta ipſam naturæ Methodum, in Claſſes ordinata.

NUMBER III. A Letter to Sir *Iſ. Newton*, ſent along with the Method of Foſſils, giving an Account of the Things needful and preparatory to the drawing up ſuch a Method. The Difficulties of it and its Uſes.

NUMBER IV. Letter to Sir *John Hoſkyns* Baronet. The Study of Foſſils never hitherto reduced to Rule, nor any Form of Art. The Writers, both the Antients, and thoſe of later Times, have confounded Things buried in the Earth, with the natural conſtituent Parts and Productions of it. Theſe diſtin-

distinguish'd, the Ranks of each adjusted, and *Fossils* divided into *Extraneous* and *Native*.

NUMB. V. Letter to the same. Of the *Ceraunia*, or *Stone-Weapons*, the *Magical Gemms*, and some other *artificial Things*, antiently in use, imagin'd by many Writers to be *natural*, with *Icons* of several of those in my Collection, brought from most Parts of the known World.

NUMB. VI. Directions for registring of the *Native Fossils*, and composing an instructive and useful Catalogue of them.

NUMB. VII. Letter to Monsieur—— at *Neufchattel*. The Assistance that this, and several other learned Men have given to the carrying on the Design of the *Natural History of the Earth*.

NUMB. VIII. To the same. Of the Origin, Nature and Constitution of the Belemnites.

NUMB. IX. To the same. Of the Coralloids, digg'd up at Land: The Nature and Origin of them.

NUM-

A Me-

TABULA

In quâ, uno intuitu, conſpiciuntur omnis generis FOSSILIA, juxta Naturæ METHODUM, in CLASSES ordinata.

FOSSILIA ſunt.

1° Opaca, inſipida, *friabilia*; in *aqua ſolubilia*: flammam non concipientia; TERRÆ; ad *Tactum*
- *læves*, & quaſi ſebaceæ; quæ *Linguæ*, ſi illi admoveantur,
  - *adhærent*. CIMOLIA-PURPURASCENS. CIMOLIA-ALBA. ARGILLA. TERRA-SAMIA. TERRA-LEMNIA, tam RUBRA, quam ALBA. BOLUS ARMENA. KILLOIA. RUBRICA molliuſcula.
  - *Non adhærent*. STEATITES. MOROCHITES, GALAXIA, ſeu LEUCOGRAPHIS.
- *Scabræ* & Siccæ. TERRA-VIRIDIS. TERRA-CÆRULEA. RUBRICA duriuſcula. TERRA-TRIPOLITANA. KILLOIA duriuſcula. TERRA-CARIOSA. TERRA-MELITENSIS. TERRA-SINENSIS, e quâ Vaſa *porcellana* dicta; fiunt. OCHRA. TERRA-FLAVESCENS. UMBRIA. CRETA. STEINOMARGA. *Geo. Agricolæ*, quæ eſt *Lac Lunæ* Ol. *Wormii*. TERRA-NIGELLA, vegetabilis, Dædala. LUTUM, MARGA. S. *Terra rubella*, Zoica, Adamica. TERRA-MISCELLA.

Appendix. GLAREA, S. SABULUM. ARENA.

2° Inſipida, *dura*, non ductilia, *nec in Aqua ſolubilia*; LAPIDES; qui mole ſunt
- *Majore*, in Strata diſpoſiti, *compoſitionis*
  - *laxioris*, ad tactum *ſcabri*. LAPIS-MOLARIS. COS, tam GYRATILIS, quam PORTABILIS. SAXUM-ARENARIUM. SAXUM-SCABRUM. SAXUM SECTILE. SAXUM-CALCARIUM. SMIRIS.
  - *ſpiſſioris*, ad tactum *læves*, quiq; attritu *aliquatenus politi* fiunt. LAPIS-FISSILIS. LAPIS-LYDIUS. COS-OLEARIA. COTICULA.
  - *duræ* & *compactæ* adeo, ut ad *Nitorem poliri* poſſint. ALABASTRITES. MARMOR, colorum variorum. OPHITES. PORPHYRITES. GRANITA.
- *Minore*; *Marmore*.
  - *Non duriores*.
    - *Figuræ* & *Conſtitutionis* incertæ & *indeterminatæ*. ROTULÆ-LAPIDEÆ. GLOBULI-LAPIDEI. LAPIDES-BORBORI. SCHIRRI-LAPIDEI.
    - *Figuræ* extùs variæ & *incertæ*, *Conſtitutionis* verò internæ *determinatæ* & regularis:
      - Compoſiti, e *Fibris* parallelis, quæ in horum pleriſq; *flexiles* ſunt, & vi *elaſtica* præditæ. GYPSUM-STRIATUM, Anglicum. AMIANTHUS ſive ASBESTOS. ALUMEN-PLUMOSUM.
      - Compoſiti e *Laminis* præſertim planis & parallelis, quæ *flexiles* ſunt & vi *elaſtica* præditæ. TALCUM. MICA G. Agricolæ, argentea ſeu alba, uti ac aurea, & nigra.
      - Qui, interpoſitione laminarum è Materia ad Fluores dictos potiſſimum accedente conſtantium *dividuntur in Talos*, ſeu partes angulares, pentagonas, ſeu hexagonas, aut alias cujuſvis figuræ angularis. LUDUS HELMONTII.
      - *Fiſtuloſi*, ex *Tubulis* eadem etiam Materia conſtantibus *compoſiti*. LAPIS-SYRINGOIDES.
      - Compoſiti è *Cruſtis* altera alteri ſuperinductis;
        - *arcte cohærentibus* nullâ intus Cavitate. BEZOAR-MINERALE.
        - *intus cavi*, cum Materiâ quadam incluſâ, Cruſtæ non adhærenti; ſed mobili;
          - *Solidâ*, & lapideâ; veteribus *Callimus* dictâ. ÆTITES-SILICEUS. ÆTITES-OCHREO-FERREUS.
          - *laxa*; uti Arena, Ochra, Creta, Terra, GEODES.
          - *liquidâ*, ENHYDROS.
    - *Figuræ* & *Conſtitutionis*, *certæ*, regularis & *determinatæ*, SELENITES. LAPIS-SPECULARIS. BELEMNITES, ſeu *Lapis Lyncis*, *Lyncurius* forte veterum. Corpora CORALLOIDEA-FOSSILIA, tam ſimplicia, quam ramoſa. Lapides Coralloidibus Foſſilibus affines STELECHITES. MYCEITES. PORPITES. ASTROITES. LAPIS-FAVAGINOSUS. FLUORES, figurati, CALGUM. CRALBUM. STALACTITES. STALAGMITES. OSTEOCOLLA.
  - *duriores*;
    - *Opaci*,
      - plerumq; *unicolores*. LAPIS-NEPHRITICUS. MALACHITES. PRASITES. IASPIS-RUBENS ægyptius, *variorum* in eodem corpore *Colorum*. LAPIS-LAZULI, ſeu Cyaneus. HELIOTROPIUM. IASPIS.
    - *Semipellucidi*;
      - *verſicolores*, prout vario ſitu luci objiciuntur, OCULUS-CATI. OPALUS.
      - *coloribus* in ſubjecto *permanentibus* CALCULI, aliquot & SILICES COMPACTIORES & ELEGANTIORES. ACHATES. LAPIS CALCEDONIUS. ACHATES MOCHOENSIS. OCULUS-BELI. ONYX. SARDONYX. LAPIS-SARDIUS, ſeu CARNEOLUS vulgatior, CARNEOLUS-ALBUS: item LUTEUS, qui rariſſimus. BERYLLUS GEMMARIORUM, qui *Carneoli* ſpecies eſt magis pellucidi, & ſaturatius rubentis.
    - *Pellucidi*:
      - colorati: TOPAZIUS Recentiorum, qui *Chryſolithos*, Veterum. HYACINTHUS, Gemmariorum. LAPIS-GRANATUS. RUBINUS Rupium. Rubinus BALASSIUS. Rubinus SPINELLUS. CARBUNCULUS recentiorum, Rubinorum ſpecies rariſſima. AMETHYSTUS. SAPPHIRUS, tam ſaturatè quam pallidè cærulea, quæ SAPPHIRUS-AQUEA dicitur. Gemma Italis AQUA-MARINA dicta, quæ forte BERYLLUS *Plinii*. SMARAGDUS. CHRYSOLITUS Recentiorum, qui *Topazius* Veterum.
      - *coloris expertes*. CRYSTALLUS. SAPPHIRUS-ALBA. ADAMAS.

3° *Friabilia*, aliquatenus *pellucida*, linguam *pungentia*, in Aqua *ſolubilia*, ea autem evaporatâ, denuo *coaleſcentia* & in Figuras angulares ſe componentia. *Salia*. (§) SAL-FOSSILE, tam RUPEUM quam GEMMEUM. Sal Cyrenaicum ſeu AMMONIACUM. TINCAL *Perſarum*, quod videtur CHRYSOCOLLA eſſe *Veterum*. NITRUM *Ægyptiorum veterum*, recentiorum NATRON, ſeu LATRON. NITRUM *recentiorum*. SALACIDUM foſſile, è quo, cum Materiâ *bituminoſâ*, *cretaceâ*, vel *metallicâ*, coaleſcente, oriuntur SULPHUR, ALUMEN, & VITRIOLUM.

4° *Flammam* facile concipientia & *Oleum* præbentia, in *Aquâ non ſolubilia*; *Bitumina*;
- *Liquida*. NAPTHA. PETROLEUM. OLEUM TERRÆ BARBADENSE.
- *Solida*. BITUMEN. PISSASPHALTON. SUCCINUM. GAGATES. Lapis AMPELITES. LITHANTRAX.

5° *Metallis affinia*, quibuſdam ſcilicet Metallorum Proprietatibus prædita, *Pondere* ſaltem & *Splendore*; *Mineralia*;
- *Fluida*. ARGENTUM-VIVUM-NATIVUM.
- *Solida*, *igne fuſilia*, ſed *non ductilia*, CINNABARIS. ARSENICUM aureum. ARSENICUM RUBRUM, ſeu SANDARACHA. PYRITES. MARCASITA. COBALTUM. LAPIS-CALAMINARIS. ANTIMONIUM. BISMUTHUM. SPELTRUM. NIGRICA-FABRILIS.

6°. *Ponderoſa*, *ſplendentia*, *ſolida fuſilia*, & *ductilia*; *Metalla*. (§) AURUM, ARGENTUM. CUPRUM. FERRUM. STANNUM. PLUMBUM.

Appendix ad Cap. de *Ferro*. HÆMATITES, S. SCHISTOS, MAGNES, MAGNESIA, ferri plùs minùs in ſe continent.

A

Methodical Distribution

OF

FOSSILS,

Of all Kinds, into their proper

CLASSES,

Viz. 1. *Earths*, 2. *Stones*, 3. *Salts*, 4. *Bitumens*, 5. *Minerals*, 6. *Metalls*.

Class 1. EARTHS,

OR Bodies opake, insipid, and, when dryed, friable, or consisting of Parts easy to separate, soluble in Water; not disposed to burn, flame, or take fire.

CAPUT I. Thoſe that, to the Touch, have a Smoothneſs like that of unctuous Bodies.

MEMBR. 1. SUCH as, if applied to the Tongue, adhere to it. FULLERS-EARTH (1). TOBACCO-PIPE-CLAY (2). POTTERS-CLAY (3). The SAMIAN BOLE, and the LEMNIAN, both the red and the white; BOLE-ARMENIAC (4). The ſofter KILLOW (5), the ſofter *Ruddle*, or, as 'tis call'd in the North, SMITT (6).

MEM-

(1) *This is call'd by ſome Writers,* Cimolia purpuraſcens.

(2) Cimolia alba.

(3) Argilla.

(4) *Theſe aſtringent Earths take their Names from* Samos, Lemnos, *and* Armenia, *the Countries from which we have them.*

(5) Killoia molliuſcula. Killow *is found in* Lancaſhire, *and mentioned by* Dr. Merret *in his* Pinax. *'Tis of a blackiſh or deep blue Colour, and, doubtleſs, had its Name from* Kollow, *by which Name, in the North, the Smut, or Grime, on the Backs of Chimneys, is call'd*

(6) Rubrica molliuſcula. *A ſort of Earth of a dusky red Colour, found chiefly in* Iron Mines, *the fineſt in thoſe of* Langron *in* Cumberland. *Some of this Earth contains as much* Iron *as to render it worth ſmelting.*

MEMBR. 2. Such as will not adhere to the Tongue. Soap-Earth (6*), French-Marking-Stone (7).

CAP. 2. Thoſe that, to the Touch, are dry, harſh, and rough. Terre Verte (8). Terre Bleue (9). The harder Ruddle (10). Tripoly (11). The harder Killow (12), or *Marking-Stone*. Rotten Stone (13). Maltese-Earth (14). China Earth (15). of which the fine Earthen-ware of *China*

 and

(6*) *Steatites.*

(7) *This probably is the* Molochites *of* Pliny: *and the* Morocthus, Galaxia, *and* Leucographis *of* Dioſcorides. *It is unctuous to the Touch, as the former is, but harder and nearer approaching the Conſiſtence of Stone. The* French *call it* Craye de Brianſon.

(8) Terra Viridis. *This owes its Colour to a ſlight Admixture of* Copper.

(9) *So does the* Terre bleue, *which is no other than a light, looſe, friable Kind of* Lapis Armenus. Terra cœrulea.

(10) Rubrica duriuſcula. *This owes its Colour to an Admixture of* Iron: *And as that is in greater or leſs proportion, the Body has a greater or leſs ſpecifick Gravity, and Conſiſtence, or Hardneſs.*

(11) Terra Tripolitana.

(12) Killoia duriuſcula. *This* Dr. Merret *calls* Lapis cœruleus ducendis Lineis idoneus.

(13) Terra carioſa.

(14) Terra Melitenſis.

(15) Terra Sinenſis.

and *Japon* is made. Yellow-Ochre (16). Gialolina (17). Umbre (18). Chalk (19). The Steinomarga (20). The Black-Earth, every where obvious on the Surface of the Ground, which we call Mould (21). Garden-Earth, or Under-Turf-Earth. Common Clay (22*). Marl (22). Loam (23).

APPEN-

(16) Ochra.

(17) *Earth of a bright Gold Colour, found in the Kingdom of* Naples, *very fine, and much valued by Painters.* Terra flaveſcens.

(18) Umbria.

(19) Creta.

(20) Steinomarga Agricolæ de Nat. Foſ. *L.* 2. *p.* 578. Agarico minerale *Fer.* Imperati *Hiſt. Nat. L.* 5. *c.* 41. Lac. Lunæ Ol. Wormii Muſ. *L.* 1. §. 1. *c.* 4. *This, when pure, is ſoft, light, and very white. 'Tis frequently found in Form of a white farinaceous Powder, but ſometimes concreted into a Maſs, ſoft, fungous, and not unlike* Agaric. *When there is a ſmall Proportion of a ſparry or arenaceous Matter incorporated with it, it renders it gritty and friable.*

(21) Terra nigella vegetabilis Dædala. *Concerning this ſee the Introduction to the* natural Hiſtory of the Earth.

(22*) Terra rubella, Zoica, Adamica. Lutum.

(22) Marga.

(23) *This is only* Marl *or* common Clay, *with a ſmall Admixture of* Sand *in it.* Terra Miſcella.

APPENDIX to Claſs 1.

GRAVEL [a] and SAND [b].

THESE do not properly belong to this Place; yet, in compliance with the common Method of the Writers of Foſſils, I ſhall mention them here; and at leaſt point forth what they are.

[a] GRAVEL, *Glarea, Sabulum*, conſiſts of *Flints*, of all the uſual Sizes, and Colours; of the ſeveral ſorts of *Pebles*; ſometimes with a few *Pyritæ*, and other *Mineral Bodies*, confuſedly intermix'd; and common *Sand.*

[b] SAND, *Arena*, Ἄμμος, Ψάμμος. Under this Title we have four Sorts of very different Bodies, *viz.*

1. *Extremely ſmall Pebles*, many of them white, ſeveral pellucid, ſome yellow, red, and of other Colours. Theſe conſtitute the true, which is indeed our common

common Sand; this being found in the *Gravel-pits* all over *England*, and particularly in thoſe about *London*, in the Sand-Pits of *Hide-Park*, thoſe about *Kenſington*, thoſe near *Woolwich*, and upon *Blackheath*. Our Microſcopes ſhew it to be only a *Congeries* of ſuch ſmall *Pebles*. The ſame ſort of *Sand* is alſo found on the *Shores* of the *Sea*, and *Rivers*; 'tis here commonly very clean and fine, the Waters ſerving to waſh, clear, and free it from Earth, Clay, Mud, and other lighter Matter; and, by that Means, to bare and uncover the *Sand*, whenever the Earth there contains any in it.

2. *The Gritt of Stone*, or Matter, of that ſort of which the *Strata* of Stone are compoſed, found lying looſe. Part of this, by reaſon of the Intermixture of Matter with it, that was earthy, lax, and incapable of Coalition, has not been conſolidated, but lay ever looſe, and in the State in which it is now found. The reſt is ſuch as has by little and little moulder'd down after Froſts; and been beat off, from the *Strata*, by the Falls of Rain, or, where

where it happens to be near them, by the Waves of the Sea, and Rivers. 'Tis found chiefly on the Sides, and at the Bottoms of Rocks; and on the Shores of the Sea and Rivers.

3. *A brittle Shattery ſort of Spar*, found, in Form of a white Sand, chiefly in the perpendicular Fiſſures, amongſt the Ores of Metalls.

4. *Small Fragments of Shells*, broken, and reduced into Form of Powder, by Means of Stones, and other ponderous hard Bodies, agitated by Tides and Storms. This is found in vaſt Plenty on ſome Shores, and is frequently made uſe of for the manuring of Land, by the Name of *Sea-Land*. See the *Reflections concerning Vegetation*, *Philoſoph. Tranſact.* N°. 253.

Claſs 2. STONES.

Or Bodies inſipid, hard; not ductile, or malleable; nor ſoluble in Water.

CAPUT 1. Those which are found in great Masses, and formed into *Strata.*

N. B. *The* Characteristic *of the Bodies in* this Chapter, *I mean, their being* formed into Strata, *does not hold so universally, but that there are small Deviations from it. Thus sometimes,* Marble *is found, not in* Strata, *but in the* perpendicular Fissures *of them; which* Alabaster *likewise is, in some Places, and indeed even a fine* Stony Matter, *as also an Earthy, e. g.* Umbre, *and* Ochre. *On the contrary,* Mineral *and* Metallic Matter, *found most commonly in the* Fissures, *is sometimes likewise found in the* Strata, *e. g.* Spar, Iron, Copper, *and the like. Nor can this be thought strange, to any one that rightly reflects upon the* Confusion *that these Bodies were in, after the* Dissolution *that befell them during the* Deluge; *and upon the* Transitions *and* Removes *that are made by Water passing the* Strata *into those* Fissures. *Vid.* Nat. Hist. Earth. *Part* 2 *and* 4. *But this whole Affair*

Affair will be ſet in a Light more clear, full, and diſtinct, whenever the Catalogues *of my* Foſſils, *both* Engliſh *and* Foreign, *ſhall come forth.*

MEMBR. 1. SUCH as are of a Compoſition more lax, and a Grain more coarſe, or rough, to the Touch. MILL-STONE (24). GRIND-STONE (25). WHET-STONE (26). SAND-STONE (27). RAG-STONE (28). FREE-STONE (29). FLAG-

(24) Lapis molaris.
(25) Cos. gyratilis.
(26) Cos portabilis.
(27) Saxum arenarium.
(28) *So named from its breaking in a* ragged, *uncertain, irregular Manner.* Saxum Conſtitutionis durioris, craſſioris *Scabræ.*
(29) *So named from its being of ſuch a Conſtitution as to be wrought and cut* freely, *in any Direction.* Saxum Sectioni in omnem Partem, & directionem, ex æquo cedens.

STONE (30). LIME-STONE (31). *Poliſhing Stone*, or EMERY (32).

MEMBR. 2. Such as are commonly of a cloſer Compoſition, and ſomewhat finer Grain, ſo as to be more ſmooth to the Touch, and in ſome ſmall Degree capable of a Poliſh. SLATE (33). TOUCH-STONE (34). OIL-STONE (35). The HONE (36).

MEM-

(30) Saxum laminoſum *'Tis call'd commonly* Slate, *merely becauſe 'tis us'd, and indeed very fitly, like Slate, for the covering of Houſes, particularly at* Bath *and in ſeveral Parts of the* Weſt. *But it will not ſplit, as* Slate *does, being found form'd into what they call* Flaggs, *or thin* Plates; *which indeed are no other than ſo many* Strata. *I have obſerv'd of them, betwixt* Caſtleton *and* Workſworth, *in the Peake of* Derbyſhire, *and in ſome other Places, from the Thickneſs of Paper, thro' all Degrees to a very conſiderable Bulk. They increaſe deſcending, the thickeſt lying ever deepeſt in the Earth. All the* Strata *of our Globe are compiled of terreſtrial Matter ſubſiding from the Water of the Deluge: and, when the Subſidence firſt began, that Matter was in greateſt Quantity; ſo that the* Strata *that lye deepeſt, muſt of Courſe be the thickeſt; and muſt grow gradually thinner, aſcending towards the Surface of the Earth, as the Water became more and more diſengag'd of it.*

(31) Saxum Calcarium.

(32) Smiris.

(33) Lapis fiſſilis.

(34) Lapis Lydius.

(35) Cos Olearia.

(36) Coticula.

MEMBR. 3. Such as are of a Conſtitution ſo hard and compact, and a Grain ſo fine, that they will readily take a bright Poliſh. ALABASTER (37). MARBLE (38) of divers Colours, both ſimple and mix'd, and found in ſeveral Countries, whence it has obtained ſeveral Names, which will be too tedious, and indeed of little Uſe to recite here. The OPHITES (39). PORPHYRY (40). The GRANITE (41) of the *Italian* Writers.

(37) Alabaſtrites.

(38) Marmor.

(39) *The Ophites of the Moderns has a dusky greeniſh Ground, with Spots of a lighter Green, oblong, and uſually near ſquare. The* Ophites *of the Antients, was little if at all different, as appears from the Fragments of it ſtill remaining in Antient Works. Beſides,* Pliny's *Account agrees well with this. He calls it alſo* Memphites *from* Memphis *in* Egypt, *near which City 'twas got.* Plin. Nat. Hiſt. L. 36. c. 7.

(40) Porphyrites.

(41) Granita. *This is the* Syonites *and* Pyrrhopœcilus *of* Pliny, Nat. Hiſt. L. 36. c. 8. *which, according to his Intelligence, was got near* Syene *in* Thebais. *He obſerves, and indeed very rightly, that the* Egyptian *Obelisks are made of this.* V. M. Mercati de gli Obeliſchi di Roma, c. 2. p. 4. *It has been long a Doubt, amongſt the Learned, where ſo great a Quantity of* Porphyry *and* Granite, *as we ſee in the works of the Antients, yet extant, in* Syria, Phœnicia, Greece, *and* Italy, *was*

CAP. 2. Thoſe which are found in ſmaller Maſſes.

MEMBR. 1. Such as do not exceed Marble in Hardneſs.

ARTICULUS 1. That are both of a Figure and a Texture that is uncertain and undeterminate. Thoſe call'd RUBBLE-STONES (42). *Copple-Stones*,

was all digg'd up. But I have learned from the late Obſervations and Travels of Mr. H. Worſely, *and ſince of Mr.* Tho. Shaw, Lett. Dec. 20. 1725. *and of ſome other curious and intelligent Perſons, that there are many vaſt* Strata, *and even whole Rocks, conſiſting intirely of theſe two Kinds of Marble in* Arabia Petræa. *Whence theſe might be eaſily carried acroſs the* Red-Sea *into* Egypt; *and, by the Mediterranean, into* Phœnicia, Greece, *and* Italy.

(42) Rotulæ lapideæ. *The Water, at the latter End of the Deluge, departing in Hurry, and with great Precipitation and Violence, bore with it, not only the looſer terreſtrial Matter, but the Nodules and harder; nay, it tore up the very ſtony* Strata, *broke them, rowl'd, and tumbled along the Pieces and Fragments frequently very far from the Places where they originally lay, rounded, ſmoothed them, and brought them to Form of Nodules. They owe their Name,* Rubble, *to their being thus* rubb'd *and worn. Theſe we find, in ſuch Countries where there is Stone, frequently in great Numbers, and of various*

Stones, or BOWLDER-STONES (45). CLAY-STONES (44). The *Stony Nodules* found lodg'd in the *Strata*, and call'd by the Workmen KNURS and KNOTS (45).

ARTIC.

various Sizes, in digging juſt within the Surface. But there are in many places, in Wales, *in* Cornwall, *and elſewhere, Maſſes of Stone, ſometimes to a vaſt Bulk. e. gr. of one, two, or more Tuns, thus torn up, and left at the Surface; of which I intend a further Account in its Place.*

(43) Globuli lapidei — *Theſe are found on the Shore: of the Sea and Rivers: are Lumps and Fragments of Stone or Marble, broke from the adjacent Cliffs, rounded by being* bowl'd, *and tumbled to and again by the Action of the Water. Whence they obtain'd the Name of* Bowlder Stones; *they being form'd by an Action like that of a* Bowl, *and thereby reduc'd to the Shape of one. Neither the* Bowlders, *nor* Rubble-Stones, *are ever inveſted with an exterior ſtony* Cruſt *or* Skin. *'Tis plain, from Conſideration of the Manner of their Formation, they cannot. This is one Mark by which they are diſtinguiſh'd from* Flints, Pebles, *and the other* native Nodules, *that were form'd before the Subſidence of the Matter of the* Strata, *and are cover'd with ſuch a* Cruſt *or* Skin, *unleſs it have been worn off by their having been, ſince their Formation, likewiſe ſo agitated and worn.*

(44) Lapides borbori.

(45) Schirrhi lapidei, *From their being, as* Knots *in Timber, commonly* harder *than the reſt of the Maſs of the* Strata, *wherein they are found repoſited, whether that be of* Chiver, Slate, *or* Stone, *in each of which they are found uſually few in Number, of different Size, Subſtance and Shape, but commonly approaching a Globular.*

ARTIC. 2. That are *externally* of Figure various and uncertain; *but, internally*, of a Texture determinate and regular.

SECTIO 1. Thoſe which are compoſed of *Fibres*, which are parallel, and which, in moſt of them, are flexible, and elaſtick. ENGLISH TALC (46), of which the coarſer Sort is call'd *Plaiſter*, or PARGET (47), the finer, SPAAD (48), EARTH-FLAX (49), or *Salamander's Hair*.

SECT. 2. Thoſe which are compoſed of *Plates*, that are generally plain and parallel, and that are flexible and elaſtick. TALC (50). *Cat-Silver*, or GLIMMER (51), of which there are three Sorts, the *Yellow* or *Golden*, the *White* or *Silvery*, and the *Black*.

SECT.

(46) Gypſum Striatum
(47) Gypſum.
(48) Spatum.
(49) Amianthus, or Asbeſtos. Lapis Caryſtius Straboni *L.*90 Geogr.
(50) Talcum.
(51) Mica Geo. Agricolæ, aurea, argentea, nigra.

SECT. 3. Thoſe which, by the Interpoſition of *Laminæ*, or Plates, conſiſting of a Talky Spar, are divided into Tali, or angular Parts, as Pentagons, Hexagons, or of ſome other angular Figure. The WAXEN-VEIN (52) of Dr. *Grew. Catal. Muſ. Soc. Reg. Lond.*

SECT. 4. Thoſe which are fiſtulous and compoſed of *Pipes*, conſiſting of a like Talky Spar. The PIPED-WAXEN-VEIN (53) of Dr. *Grew. Ibid.*

SECT. 5. Thoſe which are compoſed of *Cruſts* including one another.

SUBDIVISIO 1. Having the Cruſts adhering cloſe to each other, ordinarily to the Center of the Body, without any Cavity within. MINERAL BEZOAR (54).

SUB-

(52) Ludus Helmontii.

(53) Lapis Syringoides.

(54) *Of the* Bezoar Minerale, *ſee* P. Boccone's Recherches & Obſ. Nat. 8°.

SUBDIV. 2. Having a Cavity within, containing in it Matter, not adhering to the Cruſt, but looſe and moveable.

§ § §. 1. Solid and Stony, call'd by the Antients *Callimus*. The FLINTY-EAGLE-STONE (55). The OCHREOUS-EAGLE-STONE (56).

§ § §. 2. Lax; e. gr. Sand, Ochre, Chalk, Earth; the ELFS-EARTH-SCRIP (57).

§ § §. 3. Liquid; the FAIRY'S-WATER-BOTTLE (58).

ARTIC. 3. That are of a certain, regular, and determinate Figure, and Conſtitution. The Rhomboidal SELE-

(55) Ætites Silicius.

(56) Ætites Ochreo-ferreus.

(57) Geodes. *There's one ſort of this found commonly among the clay us'd for making Tyles and Bricks; which the Workmen call* Race *or* Rance. *The* German *Mineraliſts give it the Name of* Erdmangen, *or* Earth-man.

(58) Enhydros. Ad motum, fluctuat intus in eo, veluti in ovis, liquor, *Plin.* xxxvii. 12.

SELENITE (59). MUSCOVY-GLASS (60). The THUNDER-BOLT (61). The Foſſil CORALLOID BODIES (62), both *ſimple* and branched. The Stones related to the Foſſil Coralloid Bodies, e. gr. STELECHITES (63). The MUSROOM-STONE (64). The BUTTON-STONE (65). The STAR-STONE (66). The HONEY-COMB-STONE (67). SPAR (68), ſhot or cryſtallized.

(59) Selenites.

(60) Lapis Specularis Plinii.

(61) Belemnites, Dactyleus Idæus, Lapis Lyncis Offic. *which probably was the Lyncurius of the Antients.*

(62) Coralloidea Foſſilia.

(63) Stelechites.

(64) Mycetites.

(65) Porpites Plotii.

(66) Aſtroites recentiorum.

(67) Lapis Favaginoſus.

(68) *What we call* Spar, Laz. Erkeren, *and the other Mineraliſts that have wrote in the* German *Language, call* Fluſs. Agricola, *and thoſe who have wrote in Latin,* Fluor. *This is a mixed Body, conſiſting of Cryſtal incorporated ſometimes with* Lac Lunæ, *and ſometimes with other mineral, ſtony, earthy, or metallick Matter. Where the cryſtaline Matter prevails, and is ſuperior in Quantity, the Body is more or leſs pellucid: and ſhoots into regular angulated Figures. But, where the other Matter prevails, its Figure is uncertain and irregular.*

lized. CAUK (69). CROYL-STONE (70). The STONY-ICEYCLE (71). STONY-COMFETS, or DROP-STONES (72). OSTEOCOLLA (73).

MEMBR. 2. Such Stones as are found in leſſer Maſſes, and do exceed Marble in Hardneſs.

ARTIC. 1. That are Opake.

SECT.

(69) Kaulgum Cauk. *The Term uſed by the* Miners *in the* Peake, *to denote a coarſe talky* Spar. *The* Germans *call Talk* Kaalg.

(70) Craulgum. Cryſtalliz'd Cauk; *likewiſe from the* Peak *Lead Mines. In this the Cryſtalls are very ſmall.*

(71) *The* Stalactites *of Authors. This is only* Spar *in the Shape of an* Iceycle, *accidentally formed in the perpendicular* Fiſſures *of the Stone out of the ſparry, and other Matter that is drained out of the* Strata *by the Water paſſing thro' them intto thoſe Fiſſures.* V. Nat. Hiſt. Earth. Part iv. Conſect. 7.

(72) Stalagmites. *The* Stalagmites *is* Spar *alſo, formed by the ſame Means into the Shape of* Drops. *The* Italians *call them* Confetti di Tivoli.

(73) Oſteocolla, *Spar likewiſe, generally coarſe, concreted with earthy or ſtony Matter, precipitated by Water, and incruſted upon Sticks, Stones, and other like Bodies.* Vid. Nat. Hiſt. Earth. Part iv. Sect. 13.

SECT. 1. Thoſe which are, chiefly of one Colour. The NEPHRITIC-STONE (74). The MALACHITE (75). The ROOT of the EMERALD (76). The DIASPRO ROSSI (77), of the *Italian Antiquaries.*

SECT. 2. Thoſe which are of ſeveral Colours. L'AZURE, or ULTRA-

(74) Lapis nephriticus. *This is commonly of an uniform dusky Green; but ſome Samples I have ſeen of it, that are variegated with White, Black, and ſometimes Yellow.*

(75) *This is the* Molochites *of* Pliny. Molochites ſpiſſius virens, a Colore Malvæ nomine accepto, reddendis laudata Signis. Plin. xxxvii. 8. *He takes notice, that the Antients* commended it for *Intaglias and* Seals: *And there are in my Collection ſeveral. 'Tis ſometimes intirely green; but lighter than that of the Stone foregoing, ſo as in Colour to reſemble the Leaf of the* Mallow, Μαλάχη, *or* μολάχη, *the* Mallow, *from which it has its Name; tho' ſometimes it is veined with White, or ſpotted with Blue or Black.*

(76) Πρασίτης *Dioſcor.* Praſius vilioris eſt Turbæ *Plin.* xxxvii. 8. *Eſt æruginei Coloris. Theophraſt. Conf. de Laet. de Gem. & Lap. L.* 1. *c.* 9. Gemmarii vocant Smaragdo praſum. & Matrem Smaragdi. *De Laet. Ibid.*

(77) Jaſpis ruber, Ægyptius.

MARINE (78). The BLOOD-STONE (79). The JASPER (80).

ARTIC. 2. That are ſemi-pellucid.

SECT.

(78) Lapis Lazuli, *ſeu* Cyaneus. κύανον, Cæruleum *Dioſcorid.* περὶ ὕλης ἰατ. V. 106. *The Ground of this is blue, veined and ſpotted with White, and a gliſtering or metallic Yellow. It ſeems to be the* Sapphirus *of* Pliny, *and appears to be compos'd of,* 1ſt, *A white ſparry or cryſtalline Matter.* 2dly, *Flakes of the golden or yellow Talc, not different from thoſe in the* Micæ. 3dly, *A ſhining yellow Subſtance, very like, and indeed the ſame with the finer Marcaſite. This fumes off in the Calcination of the Stone, and caſts a ſulphurous Smell.* 4ly. *A bright blue Subſtance of great Uſe amongſt the Painters, purchas'd by them, under the Name of* Ultramarine, *at a great Price: And when rich, is found, upon Trial, to yield about* $\frac{1}{6}$ *of Copper, with a very little Silver.*

(79) Heliotropium. *This is green, ſpotted with a bright Blood-red. Tho' there are ſome of this Sort that are ſpotted with White; others with Yellow. Sometimes there is Agate or Cryſtall incorporated and united in the Maſs with this Stone.*

(80) Jaſpis. *The Baſis is uſually of a greeniſh Hue, and ſpotted with Red, Yellow, White. There are ſometimes Parts in this Stone that are in ſome Degree pellucid, appearing not unlike the Agate: Which was alſo obſerv'd by the Antient Naturaliſts.* Viret & ſæpe tranſlucet Jaſpis. *Plin.* xxxvii. 9. *This the* Italian *Antiquaries,* Buonarotti, Medaglioni antichi. Proem. p. 15. *call* Jaſpis Chalcedonia: *And ſuppoſe it to be the* Jaſpis Chalcidica Plinii.

SECT. 1. Thoſe which have Colours, changeable according to the different Poſition of the Stone to the Light. The CATS-EYE (81). The OPAL (82).

SECT. 2. Thoſe which have the Colours fix'd and permanent. The harder and finer PEBLES (83), and FLINTS (84). The AGATE (85). The CAL-

(81) Oculus Cati. *This is of a gliſtering Grey, interchanged with a Straw Colour: And anſwers the Deſcription of the* Aſteria, *given by* Pliny. *The Ancients aſſign'd that Name only with Regard to the Brightneſs and ſhining of the Stone; without any Conſideration of Figure, which the Moderns ſeem only to have minded in their* Aſteria.

—Ἀσήριος, καλὸς, λίθος ὅτι τις Ἀσὴρ Μαρμαίρων —Dionyſ. Περιηγ.

(82) Opalus. *In this there is an interchangeable Mixture of Red, Green, Yellow, and Blue. We have this Stone uſually from* Germany. *It anſwers the Character of* Pliny xxvii. 6. *and doubtleſs is the ſame with the* Opal *of the Antients.*

(83) Calculi. } *Some of*
(84) Silices. } *theſe are, thro' the whole Inſide, of the ſame Colour, Black, Brown, Grey, White: others ſpotted, or lineated with various Colours. The* Germans *call our Flint* Hornſtein, *tho' Flint is moſt commonly found in Form of* Nodules: *But 'tis ſometimes found in* thin Strata, *when 'tis call'd* Chert.

(85) Achates. *Agats are only Varieties of the* Flint Kind; *they have a grey horny Ground, clouded, lineated, or ſpotted with different Colours, chiefly Dusky, Black, Brown, Red, and ſometimes Blue.*

CALCEDONY (86). The MOCHO-STONE (87). OCULUS BELI (88). ONYX (89). SARDONYX (90). The COMMON

(86) Lapis Calcedonius. *This is of the Agat-Kind; and of a miſty Grey, clouded with Blue, or with Purple.*

(87) Achates Mochoenſis. Mocho-Stones. *Theſe are nearly related to the Agat-Kind, of a clear horny Grey, with Delineations repreſenting Moſſes, Shrubs and Branches, in Black, Brown, or Red, in the Subſtance of the Stone.* Dendrachates, velut Arbuſcula inſignis. *Plin.* xxxvii. 10.

(88) *The* Oculus Beli *of the modern Jewellers, and probably of* Pliny, *is only an accidental Variety of the Agat-Kind; having a grey horny Ground, with circular Delineations, and a Spot in the middle of them, ſomewhat reſembling the Sight of the Eye; whence the Stone had its Name.*

(89) *The* Onyx *is likewiſe an accidental Variety of the Agat-Kind. 'Tis of a dark horny Colour, in which is a Plate of a blueiſh White, and ſometimes of Red;* ονυχιον, μιχθη λευκῳ και φαιῳ παραλληλα. Theophr. *Onyx mixta eſt ex albo & fuſco parallelis. Laet. Italis* Nicolo *de Quibuſdam,* Achates bicolor. *The ſaid Colours lying parallel, their Surfaces terminating, and meeting in a Plane. The Lapidaries uſually cut this Stone into two, thro' the middle of the blueiſh white Plate; ſo that Part of the White is left adhering to the darker Colour in each. When on one or both Sides the White, there happens to lie alſo a Plate of a reddiſh or Fleſh-Colour, the Jewellers call the Stone a* Sardonyx.

(90) Sardonyx. *The Lapidaries uſually cauſe this to be cut, ſo as to ſhew three Colours, Fleſh, White and dark, lying in Planes, on one another. The* Sardonyx *is another Variety of the* Agat-Kind.

MON-CARNELION (91). The WHITE-CARNELION (92). The YELLOW-CARNELION (93). The BERYLL (94).

ARTIC. 3. That are in some Degree pellucid and transparent.

N. B. The Stones which follow in this third Article, are those which the Lapidaries usually call Gemms. *The natural* Constitution *of these having not been hitherto sufficiently explain'd, I presume it will not be thought amiss, that I premise something on this Subject; since 'tis from this only, that their proper Names can be ascertained, and*

(91) *This has its Name from its Flesh-Colour; which is, in some of these Stones, paler, when 'tis call'd the* female *Carnelion; in others deeper, call'd the* Male. *'Tis the* Sardion Theophrasti, *L.* περὶ λίθων, Sarda Plinii. *L.* 37. *c.* 6. *and the* Carneolus *of the Moderns. The* Italians *give it the Name of* Cornalina.

(92) *In the* White *of this, sometimes there is a very slight cast of Blue.*

(93) *The* yellow Carnelion *is very rare.*

(94) *The* Beryll *of our Lapidaries, is only a fine sort of Carnelion, of a more deep bright Red, sometimes with a cast of Yellow, and more transparent than the common Carnelion. The* Beryllus *of the Antients was a quite different Stone, of a Blueish-green Colour: and probably the same with our* Aquamarine.

and their true Ranks aſſign'd. The Baſis, or prime conſtituent *Matter of all of them is, when pure, wholly diaphanous, pellucid, and either* Cryſtal, *or an* Adamantine *Matter, that is more firm and hard. But we find frequently the Diaphaneity of this Matter changed and leſſen'd, by Means of a fine metallic Matter, incorporated with the diaphanous, in the original Concretion and Formation of the Stones. By the Acceſs and Mixture of this metallic Matter, I find, by various Experiments and Obſervations, which will appear in their proper Place,* 1ſt. *That the Weight,* or ſpecifick Gravity *of the Stone, is ſomewhat increaſed.* 2. *The* Hardneſs *of the Stone is varied, chiefly in the Cryſtallin Kind.* 3. *The* Figure *into which the pellucid Matter naturally ſhoots, is changed, by* Lead *incorporated with that Matter, frequently into a* Cubic Form; *by* Tin, *into a* quadrilateral Pyramid; *by* Copper, *into very* differing Figures *uncertainly; by* Iron, *chiefly into* Rhomboids. 4. *A Tincture, or* Colour, *is impar-*

imparted to the Stone, paler or deeper in Proportion to the Quantity of the additional Metal. 'Tis, in some, so little, as hardly sensibly to reflect the Light, or give any apparent Colour; when more, it gives a slight pale Colour; when more, still a deeper, and more a saturate: When so much as perfectly to obstruct all Passage of the Light, the Stone quite loses its Transparency or Diaphaneity, and becomes opake. *Of this we have Instances in the* Tin-Pyramids, *the* Iron-Rhombs, *the* Lead-Cubes, *and when join'd by* Copper, *as in the* Lap. Nephriticus, *the* Malachites, Lap. Lazuli, Heliotropium, Jasper, *and in the* yellow brassy Ludus Paracelsi; *or by* Iron, *as in the dusky blackish* Ludus Paracelsi. *When the metallic Matter is not in so great Quantity, as to refuse and bar all Passage to the Light, but yet so great as to reflect it, and shew a Colour; this, where* Lead *is the Ingredient, is* Yellow. *Hence the* Topaz, *and the* Jacinth, *which probably, with the Lead, has an Admixture of Iron, to which*

it owes the mix'd or flame Colour. When Tin *is the Ingredient, the Stone is by it render'd* black; *as in the* Tin-Grains, *and the* black Agat. *Where* Iron *is the Ingredient, the Stone is by it renaer'd* red. *Hence the* Carnelion, *the* Beryl, *the* Garnet, *the* Rubin, *the* Carbuncle, *the Amethyst. Where the Ingredient is* Copper, *if attended with any* Alcali *that may happen to join it, the Stone is* blue; *hence the* Saphire, *and the* Water-Saphire, *if attended with an* Acid, *green; hence the* Emerald. *When the Ingredient is both* Copper *and* Iron, *the Stone is of a Colour mix'd with Blue and Green. Hence the* Aquemarine; *when* Copper *and* Lead, *of a Green and Yellow, as in the* Crysolit.

By the Bounds I am tied up to, I am so restrain'd, that I can only hint that, from what has been said, may be concluded easily enough, that there can be no fix'd and unerring Test *or* Standard, *whereby the* Kinds *and* Names *of these Bodies may be constantly ascertain'd.*

tain'd. For, if the metallic Matter that happen'd to attend the Gemmeous in its Formation, and to enter the Compoſition of the ſame Stone was various and uncertain, and the Quantity of it as various and uncertain, there muſt, in courſe, be ſome Variety and Uncertainty in the Colour, *from which both the* Name *and* Kind *of the Stone is determin'd: And 'tis from this that ariſes the* Difference *and* Confuſion *that we find among the* Writers of Gemms, *both Antient and Modern. When the ſame Kind of Stone has its Varieties and Differences, the Deſcribers of it, tho' never ſo accurate, muſt needs vary and differ; tho' not ſo much as to leave no Rules or Characters whereby to diſtinguiſh and form a Judgment of moſt of theſe Bodies. For my own Part, amidſt ſo much Darkneſs and Confuſion, I hope I have not gone far out of the Way, or much miſtaken my Aim: And what I ſhall offer by and by, relating to Metals, will give ſome further Light into this ſo dark and intricate an Affair. I*

muſt not forget to take notice, that even the Placing *and* Diſtribution *of the* metallic Matter *to the ſeveral Parts of the ſame Stone, is not ever uniform, but in one Part a* Red, *or* Iron, *ſhews it ſelf, in another a* Blue, *or* Copper; *nay, in ſome Parts 'tis perfectly* clear *and* tranſparent, *without the leaſt Appearance of* Colour, *or* metallic Admixture. *Of all which* Phænomena, *there are* Inſtances *in my* Collection.

SECT. 1. Thoſe which are tinged with ſome Colour. The TOPAZ (91). The HYACINTHUS (92), or Jacinth of the Jewellers. The GARNET (93). The

(91) *This is of a yellow or Gold Colour. 'Tis the* Chryſolithus *of the* Antients.

(92) *This is of a deep rediſh Yellow, approaching a Flame Colour, or the deepeſt* Amber. *The Jewellers have two Sorts, a paler and a deeper, which they call* la Belle, *and which probably may be a Species of the* Carbuncle *of the* Antients. *The* Hyacinthus *of the Antients was certainly a much different Stone, in Colour Purple, tending to Blue, and ſomewhat reſembling the Flower of the Hyacinth, or Violet. Conf. Plin. L.* 37. *c.* 9. In Amethyſto fulgor violaceus dilutus eſt in Hyacintho. Plin. xxxvii. 9.

(93) Lapis Granatus. *This ſeems to be a Species of the* Carbuncle *of the Antients,*

The ROCKY-RUBY (94). The BALASS-RUBY (95). The SPINELL-RUBY (96). The CARBUNCLE (97). The AMETHYST (98). The SAPPHIRE (99). The WATER-

Antients. The Bohemian *is red, with a ſlight Caſt of a Flame Colour. The* Syrian *is red, with a ſlight caſt of Purple.*

(94) Rubinus rupium. *This is of a Red deep, and the hardeſt of all the Kinds.*

(95) Rubinus Balaſſius. *This is of a Crimſon Colour, with a Caſt of Purple, and ſeems, beſt of all the three, to anſwer the Deſcription of the* Ruby *of the Antients.*

(96) Rubinus Spinellus. *This is of a bright roſy Red; 'tis ſofter than either of the foregoing. Some late Writers ſuppoſe the Rubies to be deſcribed by the Antients, among their* Carbunculi.

(97) *The* Carbuncle *of the modern Jewellers is a Stone of the* Ruby-Kind, *very rare, and of a rich Blood-red Colour. Of the* Ἀνθρακες, *or Carbuncle of the Antients. See* Theophraſt. & Plin. L. 37. *c.* 7.

(98) Amethyſtus. *This is of a bright Purple.* Ἀμεθυσον οἰνοπων τι χρόα. *Theophr.* Uvas maturas Colore refert. *Laet.* Plin. ad vini Colorem accedit in violam definens.

(99) Sapphirus. *The Sapphire is of a bright blue Colour. We have this Stone from the* Eaſt Indies, *where it is call'd* Nilaa *from its Colour*; Nil, *or* Anil, *being the Word they uſe for Indigo, and probably may denote blue in general. It does not appear that this Stone was known to the* Antients. *At leaſt there is no Account of it in any of their Books extant. 'Tis certain the* Sapphirus *of* Pliny *is much different from our* Sapphire; *and his Deſcription anſwers to the* Lapis Lazuli. In Sapphiris aurum Punctis collucet. *Plin. Ita fere & Theophraſt. & Iſidor.*

WATER-SAPPHIRE (100). The AQUA-MARINA (101), of the *Italian* Lapidaries. The EMERALD (102). The CHRYSOLITE (103).

SECT. 2. Thoſe which are perfectly clear, diaphanous, and without any Colour at all. CRYSTAL (104). The WHITE-

(100) Sapphirus aquea. *This is the occidental* Sapphire, *and is neither of ſo bright a Blue, nor ſo hard as the Oriental.*

(101) *The* Aque Marine *is of a Sea or Blueiſh Green. This Stone ſeems to me to be the* Beryllus *of* Pliny. *That judicious learned Antiquary S. P.* Buonazotti *is of the ſame Opinion.* Medaglioni Antichi. *p.* 113. & alibi paſſim. Pliny *ranks it amongſt the green tranſlucid Gemms, repreſenting it as related to the* Smaragdus, *but of a Colour leſs briſk, and imitating a pure Sea-Water Green.*

(102) Smaragdus. *This is of a bright Graſs-Green. 'Tis found in Fiſſures of Rocks along with Copper Ore.*

(103) *This is the* Topazius *of the* Antients. *Vid.* Plin. 37. *c.* 8. *'Tis of a dusky Green, with a Caſt of Yellow.*

(104) Cryſtallus. *This is certainly known and diſtinguiſh'd by the Degree of its Diaphaneity, and of its Refraction: as alſo of its Hardneſs, which are ever the ſame. 'Tis found both lodged in the* Strata, *and form'd in the Veins, or perpendicular Fiſſures of them. In theſe laſt, 'tis found ever in Form of an hexangular Column, adhering at one End to the Stone, on the Side of thoſe Fiſſures, and near the other, leſſening gradually, till it terminates in a Point. This is call'd by the Lapidaries* Sprigg, *or* Rock Cryſtal: *And of this Sort*

is

is the Iris *of* Pliny, Agricola, *and Dr.* Liſter. *Philoſ. Trans.* N°. 110. *p.* 222. *that fine* Cryſtal *of the* Alps, *as alſo that of* Bohemia, Hungary, *and other Countries, as is likewiſe that found in the Tin-Loads or Veins in* Cornwall; *tho' a great deal of this is coloured, fouled, and rendred opake, by Admixture of metallic and mineral Matter with the Cryſtallin. Of this Kind of Cryſtal alſo, are the better and larger* Briſtol-Stones, *the* Kerry-Stones *of* Ireland, *the* Pſeudoadamantes *of Authors, and particularly of* A. Boetius de Lap. & Gem. p. 120. *The Cryſtal in Form of Nodules, is found lodged ſometimes in the ſtony, but chiefly in the earthy* Strata, *or among the Gravel, or other looſe Rubble left in a Train, by the Water departing at the Concluſion of the Deluge. This Sort, call'd by the Lapidaries,* Pebble-Cryſtal, *is in Shape irregular, and in Form of the common Nodules, Pebles and Flints. But there is alſo frequently found Cryſtal lodg'd in the* Strata, *in a Form regular, ever hexangular, which is its diſtinguiſhing and characteriſtic Form, and approaching that found in the Fiſſures; of this Rank are,* 1. Cryſtallus in acumen utrinque deſinens, Cryſtall pointed at both the oppoſite Ends. *Of this I have obſerv'd two Sorts; the one conſiſts of two hexagonal Pyramids, applied Baſis to Baſis.*

Aldrovandus *has an Icon of this Sort, which he calls an* Iris *in his* Muſæum. p. 941. Boetius *has another in his* Hiſt. Lap. & Gem. p 218. *The other conſiſts of two like Pyramids, but having an hexagonal Column intervening.* Boetius *has there likewiſe an* Icon *of this Sort, as has alſo* Aldrovandus p. 989. N°. 2, *where he gives it the Name of* Cryſtallum parvum utrinq; æqualiter mucronatum. *He takes it from* Geſner, De Fig. Lapid. p. 19. *who was under ſome Doubt, whether there had not been ſomething of Art uſed in the forming of it; but that proceeded from his not having made ſufficient Enquiry into theſe, and other not leſs elegant natural Productions*

WHITE-SAPPHIRE (105). The DIAMOND (106).

N. B.

ons found commonly in the Earth. Nor can I quit the Subject, without taking notice, that I have obſerved of both theſe Sorts, not only ſingle and ſeparate, but joined and united in Cluſters, ſeveral in the ſame Maſs, of which, as well as of thoſe found ſingle, there are various Samples in my Cabinets. 2. Cryſtallus Forma globoſa ſolida Pyramidibus pellucidis per totam ſuam ſuperficiem exteriorem ſurrectis obſita, the Echinated Cryſtallin Ball. *I have rarely obſerved any of theſe Balls, that have exceeded two inches in diameter.* 3. Cryſtallus globoſa externè rudis & ſcabra, intus cava, Cavitatem totam habens Pyramidibus Cryſtallinis obſitam, the concave Cryſtallin Ball. *I have obſerved of theſe* Cryſtal Pyramids, *tho' commonly tranſparent and diaphanous, ſome that have been tinged Yellow, others red, others purple. The exterior Surface of the Cruſts and Shells of theſe* Balls *are commonly of a brown ruſt Colour, conſiſting chiefly of a coarſe Spar, with ſome little earthy, ſtony, Mineral, or metallick Matter incorporated with it. I have obſerv'd theſe Balls of all ſizes, from the Bigneſs of a Walnut, to that of the largeſt Melon. They are ſeldom exactly round, but of a Figure nearly approaching it, tho' ſomewhat compreſs'd. The three foregoing Kinds are found in moſt Countries; but I have obſerv'd them in greateſt Plenty about* Briſtol, *chiefly in the Neighbourhood of* Kings-Weſton *in* Glouceſterſhire.

(105) Sapphirus alba. *The white Cryſtalline Sapphire, is ſo called becauſe 'tis of full as great ſpecific Hardneſs as the Blue, but colourleſs, and clear as Cryſtal.*

(106) Adamas. The Diamond. *This Stone is preferable, and vaſtly ſuperior to all others in Luſtre and*

N. B. *The* Characteriſtic *of the Stones of this Section, I mean, their being* perfectly clear, diaphanous, and without any Colour at all, *does not hold ſo univerſally, but that there are Deviations from it: And they are found ſometimes tinged and coloured. Thus there is Cryſtal, having nearly the ſame Degree of Hardneſs with the common, that is notwithſtanding of a* yellow Hue; *as likewiſe of a* Red, *of a* Blue, *or of a* Green. *To theſe the* Writers *of* Gemms *have given the Names of* Pſeudo-Topaſius, Pſeudo-Beryllus, Pſeudo-Sapphirus, *and* Pſeudo-Smaragdus, *Conf. A. Boet. de Lap. & Gem. L.* 2. *c.* 72. *p.* 219. *Sometimes Part of the Stone is clear, and Part tinged, not only with one ſimple Colour, but perhaps with two, or more, all different. In the ſame Manner, the oriental* Sapphire, Topaz, Amethyſt, Emerald, and Ruby, *are all of the ſame Hardneſs.*

and Beauty: As alſo in Hardneſs, which renders it more durable and laſting, and therefore much more valuable than any other Stone. Such it has been reputed in all Ages, and by all Nations: And indeed the very Top-Jewel of the whole Creation.

There are Diamonds *tinged with* Yellow: *Others with* Red, Blue, *or* Green, *tho' theſe laſt be very rare. The Tinctures and* Colours *of theſe, as of all other Gemms, and Stones, are owing to the Principles aſſign'd above; I mean metallic and mineral Matter, incorporated with the diaphanous, at the firſt Formation of the Body. That they actually are ſo, and the Thing really Fact, I have given ſeveral Inſtances in the* Catalogues and Accounts of the Foſſils, both of my *Engliſh,* and Foreign Collections; *as alſo various Proofs from* Trials *in the* Fire, *and Illuſtrations by* Chymical Experiments *in my* Art of Eſſaying, *and ſome other Papers.*

Claſs 3. SALTS.

Or Bodies friable and brittle, in ſome degree pellucid, ſharp, or pungent to the Taſte, diſſoluble in Water, but, after that is evaporated, incorporating again, cryſtallizing, and forming themſelves into angular Figures.

The

The FOSSIL-SALT (1). SAL-AMMONIAC (2). The TINCAL (3) of the *Persians.*

(1) Fossil, *or* Rock-Salt, *and* Sal Gemmeum; *so call'd from its breaking frequently into Gemm-like Squares. These two Salts differ not in Nature or Property from each other: Nor indeed from the Common-Salt, of the Salt Springs, or from that of the Sea, when all are equally pure and free from extraneous Matter.*

(2) Sal Cyrenaicum seu Ammoniacum nativum veterum. *Plin. L.* 37. *c.* 7. *&* *Dioscorid. L.* 5. *c.* 126. *according to* Fr. Imperati, De Fossil. p. 20. *'Tis found still in* Ammonia, *the Country mention'd by the Antients, and from which it had its Name. His Account is confirm'd by Mr.* Jezreel Jones, *who, having liv'd sometime in the Kingdom of* Morocco, *and made himself Master of the Language, was, at the Expence of Dr.* Tenison, *late Lord Arch-Bishop of* Canterbury, *my Lord* Somers, *Sir* Hans Sloane, *my self, and some others, Lovers of natural History, sent, about the Year* 1705, *into the Country thereabouts, to make Observations and Collections: And he found this Salt, native, in the Earth, in several Places. This, as likewise* Tincal *and* Natron, *are not simple Bodies; but different Salts concreted with a small Admixture of some terrestrial Substance.*

(3) *The* Tincal *of the* Persians. *This seems to be the* Crysocolla *of the* Antients; *and is what our Borax is made of. The* Indians *of* Bengal, *where there are great Quantities of it brought d wn the* Ganges, *call it* Swagar.

ſians. NATRON (4). The NITRE (5) of the Moderns, or Petre-Salt. The FOSSIL-

(4) *This is the* Νίτρον, Nitrum *of the* Egyptians, *and had its Name from* Nitria *a Province of that Country in which chiefly 'twas found; but 'tis call'd there at preſent* Natron, *or* Latron. *Dr.* Huntington, Epiſt. *p.* 68. "Latron Aquis in Nitria "Ægypti deſerto, —Su- "pernatat ad modum Gla- "ciei, cui maxime ſimile "eſt, ſed durius, rubeſ- "cens. Carnem inſulſam "gratam reddit. *p.* 69. "—Deſertum, quod o- "lim Nitriæ, hodie S. "Macarii dicitur, Locus "eſt ſteriliſſimus—. A- "qua ſalſa eſt. Arbores "nullæ ſunt, neque Ar- "buſta, nullæque præter "Alcali, Herbæ. *Conf.* "*Diſc. of Vegetation.* "*Philoſ. Tranſ. June.* "1699. Tenet equidem "Salis lacum æque ac "Nitri, nec non Lapi- "dum, Calcis, & Margæ "Fodinas. *There have been made ſeveral Experiments upon* Natron, *by the Operator of the* Acad. des Sciences, *of which there is an Account in Dr.* Tournfort's *Preface to his* Hiſt. des Plantes aux Environs de Paris. *p.* 11. *Conf.* 37.

(5) Nitre, *while in its* native *State, is call'd* Petre-Salt; *when refin'd,* Salt-Petre. *'Tis of Uſe in* Vegetation. Vid. Diſc. of Vegetation. Ib. *and that it might be every where ready, and at hand, to ſerve that important End, 'tis ſcattered about, and mix'd with the Earth, near the Surface, on which* Vegetables *are produced in all Countries quite round the Globe. But 'tis found likewiſe lying very ſhallow, and but juſt underneath the Turf, in much the greateſt Quantity that we know of, about* Patnaſs, *in the northern Parts of the Kingdom of* Bengal; *whence we have ours. Father* Fœlix White, *was, on Account of his Miſſion, ſome Time in the Country where this Salt is got*

FOSSIL-ACID-SALT (6), ſeldom found ſimple and pure, but in Form of SULPHUR, ALUM, or VITRIOL.

Claſs 4. BITUMENS.

OR Bodies that readily take Fire, and yield an Oyl; and that are ſoluble in Water.

CA-

got; and he favour'd me with a Relation of the incredible great Plenty of it there, the Manner in which it lies, and all Circumſtances of it; but that Relation is too long to be inſerted here.

(6) Sal Acidum Foſſile. *This is indeed the Baſis of* Sulphur, Alum, *and* Vitriol. *The ſimple Salt, extracted out of any of the three indifferently, is the ſame; and is capable of conſtituting either of the other; with the Addition of a ſmall Proportion of a* bituminous, cretaceous, *or* metallic *Matter.* Sulphur *is produced by incorporating an* oily *or* bituminous *Matter with this* Salt. Alum *is produced, by joining a* cretaceous *or other like earthy Matter with it.* Vitriol, *by Addition of a* metallic *Matter. If* Iron *be made uſe of, the* Vitriol *will be* green; *if* Copper, Blue.

CAPUT 1. Thoſe that are liquid. NAPHTHA (1). PETROLEUM (2). BARBADOES-TARR (3).

CA-

(1) Naphtha, νάφθα, Dioſcor. *L* 1. *c.* 101. Strabo, Geogr. *L.* 16. *repreſents it as a Liquation of* Bitumen. *It ſwims on the Top of the Water of Wells and Springs.* Salmaſ. Exerc. in Solin. *That found about Babylon is in ſome Springs whitiſh, tho' it be generally black,* Strabo, Ib. *and differs little from* Petroleum.

(2) Petroleum *is a* liquid Bitumen, *Plin.* xxxv. 15. *black, floating on the Water of Springs. Such is that of a Spring riſing at the Foot of a Mountain near the Sea, in the Iſland* Zant, *mention'd by the Antients. Sir* Geo. Wheeler *has alſo given an Account of it in his* Voyages, *p.* 48.

(3) Oleum Terræ Barbadenſe. *See* Ligon's *Hiſt. of* Barbadoes. *It differs little from the Petroleum, found floating on a ſmall Spring at* Pichford *in* Shropſhire, Camden. *and in other Springs of* England, *and of* Scotland. *Sir* Robert Sibald Prodr. Nat. Hiſt. Scotiæ. *Part* 2. *L.* 4. *c* 4.

CAPUT 2. Thoſe that are call'd Bitumen (4). Pissasphalton (5). Amber (6). Ieat (7). Cannel-Coal (8). Pit-Coal (9), *Stone-Coal, Quarry-Coal, Sea-Coal.*

Claſs

(4) Bitumen. Ἄσφαλτος. Dioſcorides *L.* 2. *c.* 99. *mentions it as found about* Sidon in Phœnicia, *in* Zant *and* Sicily, *but prefers that of* Judæa *to all others.* Dioſcor. Strabo, *and others of the Antients, aſſert, that both* Bitumen *and* Petroleum *are found plentifully about* Babylon; *which very remarkably confirms the* Moſaic *Account of the Uſe of it as* Mortar, *in building the Tower of* Babel, Gen. xi. 3. *Nay, the Buildings of old* Babylon *were, like that Tower, of Brick cemented with* Bitumen. Strabo, *L* 16. Plin. *L.* 35. *c* 15.

(5) Πισάσφαλτος *was found in the* Ceraunian *Mountains of* Apollonia, Dioſcor. *L.* 1. *c.* 100. *The antient* Greeks *gave the Name of* Πισάσφαλτος *to the* liquid, *as well as to the* ſolid Bitumen.

(6) Succinum Lyncurion *Demonſtratus ap. Plin. L.* 372. *Græcis,* ἤλεκτρον: *Germanis Veteribus,* Gleſum. *Tacit. de Morib. Germ. c* 45. *Arabibus,* Karabe.

(7) Gagates. Γάγαλος. *Dioſcor.* v. 146. Gagates Lap. niger eſt, planus, pumicoſus, non multum a Ligno differens, levis, fragilis. Plin. *L.* 36. 19.

(8) *This ſeems to be the* Lapis Ampelites *of the Antients.* Bitumini ſimillima eſt Ampelites. Plin. xxxv. 16. Ἀμπελίτις Dioſcor. *L.* 5. *c.* 181.

(9) Carbo foſſilis Carbo ſaxeus. λιθάνθραξ.

Claſs 5. MINERALS.

OR Bodies nearly related to Metals; as having ſome Properties in common with them, being particularly ponderous, and ſplendent with a metallic Brightneſs.

CAPUT 1. Thoſe that are fluid. NATIVE-MERCURY, or VIRGIN-QUICK-SILVER (1).

CA-

(1) Dioſcorides *takes notice of* Quick-Silver *that was native, and found in the Earth fluid, free, and without Mixture: and calls it* ὑδράργυρος καθ' ἑαυτὸν, Mercury *is a Mineral of very ſingular and peculiar Nature, and differs from all others in keeping conſtantly a fluid Form, when pure, ſeparate, and unmix'd. Nor can it ever be fix'd, or brought to Conſiſtence and Solidity, by any Art whatever. It amalgams with all Metals, except only Iron, and is ſuſceptible of a more conſiſtent Form, when united with Nitre, Alum, or other acid Salts, and with Arſenic, or Sulphur. But, when diſengaged from them, and ſeparated again, it ever appears in its original natural Condition, and fluid as before. Would our* Alchymiſts, *who work much on* Mercury, *reflect rightly on this, 'twould put an End to their troubleſome, expenſive, and deluſive Amuſements. 'Tis call'd* Χυτὸν ἄργυρον *by* Theophraſt. de Lap. ὑδράργυρος *by Dioſcor. L.* 5. *c.* 110. Hydrargyrum *by* Pliny, *L.* 33 *c.* 8. Argentum Vivum, *ibid. L.* 33. *c.* 6.

CAPUT. 2. Those that are solid, and will melt in the Fire, but are not ductil or malleable. NATIVE-CINNABAR (2). NATIVE-YELLOW-ARSENICK (3). NATIVE-RED-ARSENICK (4).

G The

(2) Cinnabar *is the Ore out of which* Quick-Silver *is drawn, and consists partly of a mercurial, and partly of a sulphureo ochreous Matter.* Dioscorides, *L.* 5, *c.* 109, 110. *calls it* Ἄμμιον, *or as other Copies have it,* Μίνιον, *and makes a Distinction betwixt this, and* Cinnabar, Κιννάβαρι. *The former, he says, they had from* Spain, *the latter from* Africa; *and probably there might be some Difference betwixt them; but, by the Properties and Uses he ascribes to each, they seem to be of the same Kind. At least* Pliny *tells us expressly some of the* Greek *Writers called that* Cinnabari, *which the* Romans *called* Minium, *and out of which they extracted their* Hydrargyrum. *Others called it* Miltos; "Milton "vocant Græci Minium, "quidam Cinnabari *L.* 37. c. 7. conf. c. 8. I. Ant. Saracenus *Not. in* Dioscorid. *corrects the Place, and substitutes* Ammion; *but without Reason,* Μίλτος *being the Word used by some of the* Greek *Writers, and particularly by* Strabo, *constantly.* Theophr. *L. de Lap. uses only the Word* Κιννάβαρι; *so that 'tis plain, that ours and the Antient* Cinnabar *is the same*

(3) Arsenicum Aureum nativum. Ἀρσένικον *Dioscorid. L.* 5. *c.* 121. Auripigmentum, *Plin. L.* 35. *c.* 6. *&* *L.* 33. *c.* 4. Arsenicum, *L.* 34. *c.* 18.

(4) Arsenicum rubrum nativum, Σανδαράχη Dioscorid. *L.* 5. *c.* 122. Sandaracha. Plin. *L.* 34. *c.* 18. *This is mention'd by* Agricola de Nat. *Fossil. L.* 3. Fr. Imperati. *de Foss. p.* 29. Ol. Worm. Mus. *L.* 1.

The Pyrites (5). The Marcasite (6). Cobalt

L. 1. *Sect.* 1. *c.* 12. *and others.* The Hungarian Sandaracha *is of an Orange Colour: But that from* East India *of a deeper Red. I have Samples of each; but both are very rare.*

(5) Pyrites. *This Body ever contains more or less of the* Sal acidum, *that is incorporated with an oleose or bituminous Matter, and so constitutes a* Sulphur. *This renders it so apt to give* Fire, *from which it has its* Name Πυρίτης. πῦρ. Fire. *It sometimes contains a cretaceous, or ochreous, and constantly a metallic Matter, in it: In proportion, as any of these prevail in Quantity, and come forth incorporated with the Salt, it appears in form of* Sulphur, Alum, *or* Vitriol. *Conf. Not. ad Class.* 3. *supra. I never met with any* Pyritæ *that held* Lead *or* Tin. Copper *there is in some of them; and* Iron *in all: but the Quantity of it is not considerable. In those that hold most of it, when the Salt is drawn off, the* Iron *usually constitutes about* $\frac{1}{8}$ *of what remains. They all hold an extremely small and inconsiderable Quantity of* Gold, *and some few of* Silver.

(6) Marcasita. *The Writers of Minerals generally give the Name* Pyrites *and* Marcasita, *indifferently, to the same sort of Body: And indeed they both agree in some Things. But I choose rather to restrain the Name of* Pyrites *wholly to the* Nodules, *or those that are found lodged in* Strata, *that are separate, and not a Part of, or depending on the common Matter of the* Stratum. *The* Marcasite, *on the contrary, is Part of the Matter that either constitutes the* Stratum, *or is lodged in the perpendicular* Fissures *of the* Strata. *The* Marcasite *frequently holds* Arsenic; *which the* Pyrites *does rarely, if ever. There is* Sulphur *in all* Marcasites: *And* Antimony *and* Bismuth *in some. The* Metalls *they yield*

COBALT (7). CALAMIN (8). ANTIMONY (9). TIN-GLASS (10). ZINK (11). WAD, or BLACK-LEAD (12).

Clafs 6. METALLS.

OR Bodies that are ponderous, fplendent, folid, will melt in the Fire, and are ductil or malleable.

yield are chiefly Copper, Iron, *and* Tin. *When any of thofe Metalls were in conſiderable Quantity, theſe Bodies loſe the Name of* Marcaſites, *and are call'd* Ores. *In* Cornwall, *and the* Weſt, *they call them* Mundick, *in which there is commonly* Copper, *or* Tin, *and ſometimes* Iron. *But* Mundick *abounds ſo much in* Sulphur, *that the Metalls are very difficult to be parted. Being run down all together, they compoſe a Kind of* Bell-Metall, *uſed by ſome for making Bells, Mortars, and the like.*

(7) Cobaltum, *a* Marcaſite *frequent in Saxony. It is plentifully impregnated with* Arſenic, *contains* Copper, *and ſome* Silver. G. Agricola, In Bermanno *p.* 690. 701. Ol. Wormius, Muſæum. *p.* 128. *and the reſt of the Writers of Minerals take this for the* Cadmia *of the Antients. Being ſublim'd, the Flores are of a blue Colour. This the* German *Mineraliſts call* Zaffir.

(8) Lapis Calaminaris.

(9) Antimonium S. Stibium.

(10) Biſmuthum.

(11) Speltrum.

(12) Nigrica fabrilis, Merreti. Pinax Rer. Nat. Britan.

1. GOLD. 2. SILVER. 3. COPPER. 4. IRON. 5. TIN. 6. LEAD.

FROM what I have deliver'd on another Occaſion † concerning the Confuſion that Things lye in under Ground, and the various Combinations of Metalls amongſt themſelves, and their Mixture with almoſt all other Sorts of terreſtrial Matter whatever, may readily be concluded how difficult a Task it is to deſcribe the Ores of them, and diſtinguiſh each from other. I have for ſome Years been carefully examining thoſe found in *England*, and procured Samples from moſt other Parts of the known World. What Rules and Diſtinctions of the various Sorts I have been able to make, I ſhall next deliver as clearly as the Bounds I am tied to will permit.

1. GOLD, *Aurum*, χρυσὸς. This Metall conſiſts of Parts ſo infinitely ſubtil and fine, that when 'twas all in ſolution, and

† *Nat. Hiſt. Earth. Pt.* 4.

thoſe

thoſe Parts divided, and abſolutely ſeparated each from other, which was the Caſe at the Deluge, they would be ſo eaſily agitated and diſperſed about every where, that 'tis not ſtrange that we find more or leſs of this Metall incorporated with almoſt all Kinds of terreſtrial Bodies whatever. But, as it ſeems, the main Bulk of it, before the Diſſolution at the Deluge, lay chiefly in ſome particular Places, it ſubſided again in them; and there chiefly it muſt of courſe be at this Day found. 'Tis interſpers'd, mix'd, and incorporated with the *Strata* of the Earth or ſtony Matter; and the Particles of it commonly ſo ſmall, as not to be diſcernible; but ſometimes they lye ſo cloſe and thick, as well to compenſate the Labour and Expenſe of waſhing away the Earth wherein they were lodged; and the ſtony Matter, after 'tis beat, broken, and finely reduc'd: For when this is ſeparated by Means of Water, and decanted off, the Gold, being ponderous, all readily ſubſides to the Bottom; by which Means 'tis collected and preſerv'd. In this Manner 'tis wrought in the Mines of *Cânia*, and

and other Parts of *America*; in *Achin*, and other Parts of *India*, and the Eaſt; and in the Mid-land Parts of *Africa*. Gold is found likewiſe in the *Strata* in bigger Particles, Maſſes, and Lumps of various Sizes. The largeſt that I have ſeen of Gold thus ſeparate and pure, taken out of a *Stratum*, weigh'd near three Ounces. But ſuch are very ſeldom met with; though there are Accounts of Princes, and great Perſons, living in the Countries where the Gold is got, that have much larger Lumps and Nodules of it. Beſides, the Gold thus found in the *Strata*, 'tis likewiſe met with in the Veins and perpendicular *Fiſſures* of them, either incorporated with the Sparry, Mineral, or metallic Matter repoſited there, or ſeparate and pure. This laſt is ordinarily found adhering to the *Spar*, and run into Form of *Threads* and *Grains*; whence it has obtain'd the Name of *Aurum nativum fibroſum, & granulatum*. Sometimes ſuch is found concreted and affix'd to the Stones on the Sides of the *Fiſſures*. Of all theſe there are Samples in my Collection.

THEN there is found Gold in Form of Duſt, Powder, Grains, and Lumps, at, or near the Surface of the Earth; but chiefly on the Shores and Strands of the Rivers, and on the Sides, and at the Feet of Mountains. This is all waſh'd forth of the Earth by the natural Action of Water; that found about Rivers, partly by their common flowing and wearing of the Banks, and partly by their more forcible Action, when there are great Tides, and Inundations; the Water waſhing away the lighter terreſtrial Matter, and ſo bareing, uncovering, ſeparating, and leaving behind the more heavy Metallic. In this Manner Gold has been found in all Ages; not only in the Countries where it abounds, and there are Mines of it, but in *Greece, Spain, Hungary,* and other Parts where there are none. That found about Mountains is waſhed forth by the Falls of Rains. Theſe in ſome Countries are very great, powerful, and fall conſtantly at certain Seaſons. They waſh away the earthy, and even the looſer ſtony Matter; by

by which Means they diſcloſe the Gold: And where it happens to be repoſited in any conſiderable Quantity within, after the Rains are over, 'tis found left on the ſides of the Mountains, and about the Bottoms of them, in Plenty proportionate to the Greatneſs and Duration of the Rains. This is the Caſe of the Gold of *Quito* in *Peru*, and of moſt of that we receive from *Guinea*, and other Parts of *Africa*, where the Mountains, chiefly thoſe up in the Country, abound with this Metall. Upon Trials in the Fire, I have found ſome of this *African* Gold ſo rich and pure, as to yield 97 or 98 *per Cent*.

2. SILVER. *Argentum*, Ἄργυρος. This Metall is found in the Veins and Fiſſures of the *Strata*, ſometimes native and pure, adhering either to the Stone on the Sides, or to the ſparry, or other mineral Matter in the Veins, in various Forms, e. gr. of *Hairs* or *Threads*, finer or thicker, of branch'd *Shrubs*, and of *Feathers*; as alſo ſometimes of *Grumuli*, *Maſſes* and *Lumps*; from which Forms it has obtain'd

obtain'd the Names of *Argentum Capillare, Fibroſum, Arboreſcens, Plumoſum, Grumulatum, Concretum.* The fineſt Silver Ore of *Saxony*, is incorporated with *Sulphur* and *Arſenick*, which together impart to it a ruddy Hue. This Sort the Miners there call *Rothgultig-Ertz.* But in *Germany, Hungary, England,* and other Parts of *Europe,* the Silver is ſeparated from the Ore of *Lead*, chiefly, that ſhining, ſparkling Sort, that the Miners call *Steel-grain'd Ore.* I have, upon Trial, extracted from ſome of this, one 15th Part of Silver; but ſo great a Proportion is not common.

3. *Copper, Æs,* κύπριον, * *Cuprum,* χάλκος. The principal Varieties, and Sorts of the Ores of this Metall, are the *Pale-grey,* the *Black*, the *Red*, the *Gloſſy-Purple,* the *Blue,* the *Æruginous* or *Green:* The better Sort of *Mundick,* or the *Marcaſitic Yellow*, ſhining, Braſs-like Copper-Ore; the *fibrous,* or ſtriated, and the *ſparkling or Steel-grain'd.* Be-

**Quoniam in Inſulâ* Cypro *copioſè prognatum. Vide* Plin.

ſides, this Ore is ſometimes found native and pure, in Form of *Threads;* of *Shrubs* in *Flakes* and *Plates,* ſome ſolid and continuous, others porous; in *Grains, Maſſes,* and *Lumps.* Theſe paſs all in general, by the Name of *Virgin-Copper-Ore:* And many of them are ſo pure, as to be flexile and malleable, like the refin'd Metall it ſelf. *Terre-verte, Terre-bleue* and *Ultramarine,* which is the blue Part of the *Lapis Lazuli,* all contain ſome Copper in them. The *Lapis Armenius,* † is really a Copper Ore, but generally very poor; tho' there is, in my Collection, ſome ſo rich, that it yields one third Copper.

4. *Iron, Ferrum,* σίδηρος. I have obſerved above, that *Gold* is found intermingled with the ſandy, earthy, or other common Matter of the *Strata.* I ſhould have taken notice above, that *Copper* is found ſo too; and renders the Stone wherein it is contain'd, of a Green or a Blue, or a ruddy coppery Hue. Iron is frequently found

† Dioſcorid. περὶ ὕλης ἰατρ. *L.* v. *c.* 105.

found in the same Manner in the *Strata;* and, when in Quantity, imparts a ruddy or ferruginous Colour to them: But neither Silver, Tin, nor Lead, are ever found in any considerable Quantity in the *Strata.* The harder red ochreous Iron-Ores, pass by the Name of *Rudle;* the softer by the Name of *Smitt.* There is more or less of this Metall likewise incorporated with the ferruginous crustated Bodies, the ochreous *Rust-coloured-Eagle-Stone,* the *Bezoar Mineral,* the ferruginous *Geodes,* and the *Enhydros.* There is found Iron-Ore, in Form of *Ludus Helmontii,* particularly in *Monmouthshire,* where this Sort is call'd *Pin-Ore.* The rest of the Sorts are, The *smooth-grain'd Iron-Ore,* which strikes Fire, and breaks much like a Flint, but is of a ruddy Colour: The *Hæmatites,* or *Schistos,* † which is of a striated, or fibrous Texture, and the *Iron Stalactitæ;* several of these naturally united into one Sheaf, pass by the Name of *Brush-Ore.* The *Rhomboid-Iron-Grains.* I have seen,

† Dioscorid. *L. c.*

in the Mines of the Forreſt of *Dean* ſome little Iron Ore, in the Veins, ſhut into a *Ramoſe*, or *arboreſcent Form*. Iron is ſeldom found native and pure. I never ſaw but one ſmall ſample of it, which came from *Saxony*. But ſome of the richeſt Ores of this Metal, both the *Engliſh*, and thoſe from *Germany*, being reduc'd to a very fine Powder, the purer Iron Grains follow and obey the Load-ſtone. *Magnes* the *Loadſtone* alſo holds a little Iron, and is ſometimes found in the Veins, along with the Ores of that Metall; as is alſo the *Magneſia*, or *Manganeſe*: And indeed this differs little from the *Hæmatites*, only that it is poorer, and yields leſs Iron. *Smiris*, or *Emery*, has likewiſe uſually in it ſome ſmall Admixture of *Iron*.

5. *Tin*, *Stannum*, κασσίτερος. There is of the Ore of this Metall got in leſſer Quantities, in *Saxony*, and in *Bohemia*, and ſome on the Coaſts of *Malabar* in the *Eaſt Indies*. But no Part of the World yields ſo much of it as *Cornwal*, nor ſo rich and good. This is the only Product of

of the Nation, that was ſent Abroad, before the *Romans* came hither. The *Britains* had, from the remoteſt Antiquity, carried on a Trade with the *Phænicians* in this Commodity. They ſent it in Boats, the beſt they had in thoſe early barbarous Times, made of Wicker, and cover'd with Hides of Beaſts, to the Iſle of *Wight*, and thence, to the oppoſite Coaſts of *France*, whence 'twas carried over Land to *Marſeilles*; where the *Phænicians* bought it, and tranſported it to all Places with which they had Commerce. The principal Sorts of *Tin-Ore* are the *Pale*, near *White*, the *Grey*, the *Brown*, the *Ruddy*; but the beſt and richeſt is the *Black*. I have never ſeen, nor heard of any *native pure Virgin Tin*. The *Tin Grains*, or *Tin Corns*, as the Miners call them, are the richeſt, and yield about half Metall. There are ſometimes a very few Sparks of Metall in that ſort of Stone that the Tinners call *Pedancarn*, and in that which they call *Growan*. This laſt is a gritty Stone, of various Colours, and of *Talky* Conſtitution, having *Micæ* in it. The *Tin-Veins*, or as the

the Miners call them, *Loads*, are either in *Strata* of *Growan*, or of that grey, *Talky*, *Slaty* Stone, that the Tinners call *Killas*, *Raze*, or *Delvin*. The greateſt Quantity of Tin-Ore is found in the *Loads*; but there is of the very ſame Sorts, found likewiſe in the *Shoads* or *Stream-Works*. Theſe are Trains of Ore, Spar, and other Minerals, that were waſhed down from the *Loads*, by the Water departing at the End of the *Deluge*. Mr. *Carew*, in his *Survey of Cornwall*, has given ſome Account of thoſe *Shoads*; but I have obtain'd a much fuller, more particular, and ſatisfying Account from ſome of the Gentlemen of that County, and Stewards of the Tin Mines, that have been curious, and taken Pains in making accurate Obſervations on the State of Things there.

6. *Lead*, *plumbum*, μόλυβδος. The various Names and Diſtinctions of this Ore, uſed by the Workmen, are, the *Potters* or *Blue*, the *Grey*, the *greeniſh Yellow*, the *Talky*, the *Stony*, the *Cavernous*, the porous Sort, call'd on *Mendip*, *Honey-Comb*

Comb Lead-Ore, the *Star-grain'd* Lead-Ore, the *ſtriated*, or *Antimoniated* Lead-Ore, the *ſparkling* or *Steel-grain'd*; this commonly yields more or leſs Silver, and is what *Dioſcorides*, and the Naturaliſts after him, call *Molybdæna: Pliny*, *Galena*. The *White* ſemi-diaphanous Lead-Ore, generally fibrous, but ſometimes *flaky* or *plated*. The *Ericoid*-Lead-Ore, found concreted into the Form of the *Ramoſe* Moſs, or, as ſome fancy, of *Heath* or *Erica*, whence it had its Name. The *Diced* or *Cubic* Lead-Ore. The *Saxon* Mineraliſts ſometimes find Lead in the Veins, that is *native* and *pure*: But I never ſaw any except one Sample that was fetch'd for me, with ſeveral other Ores, from *Mendip*, by Mr. *John Hutchinſon*, a Man brought up from his Youth in Mines, in the Service of Dr. *Bathurſt* and Mr. *Squire*. Mr. *Auditor Harley* and I borrowed him of his Grace the *Duke of Somerſet*, whoſe hired Servant he then was, and ſent him into the Weſt, to make Searches and Collections for us.

I can-

I cannot well diſmiſs the Subject, without taking ſome brief Notice, of thoſe which the Miners call *Mock-Ores*, or *Samples of Veins*, as judging them to be *Signs* of *Ores* lodged ſomewhere near. That does not always happen, tho' indeed they are commonly found at the Tops of the metallic Veins. The greateſt Part of theſe are very light, porous, and friable; but ſome there are that are ſolid, and ſo ponderous, that they certainly hold Metall, tho' ſo intimately incorporated with the Mineral Ingredients of the Maſs, as not to be extricated, or ſeparated from them, by any Proceſs yet found out. I ſhall conclude, after I have given the Names of the principal Kinds. Theſe are *Mock-Lead*, *Blind*, *Blend*, *Black-Talk*, or as the *Germans* call it, *Sterile-Nigrum*. *Mock-Tin*, or *Cockle*. *Mock-Copper*, or *Goſſens*, a Corniſh Mineral, as is alſo *Mundick*, a ſort of braſſy Marcaſit there. *Mock-Iron*, or *Call*, likewiſe the Product of *Cornwall*. *Mock-Hæmatites*, Mock-Sparry, and Talky-Ores.

FINIS.

LETTERS

Relating to the Method of Foſſils.

LETTER I.

TO

Sir ISAAC NEWTON.

A Letter ſent along with the Method of Foſſils, giving an Account of the Things needful and preparative to the drawing up ſuch a Method. The Difficulties of it, and its Uſes.

SIR,

I SEND you, with this Letter, a *Tract* relating to the Method of *Foſſils*; which, if not your own, is wholly owing to you; it being begun, carried on, and finiſhed at your Requeſt. It is indeed a Work,

tho' ſmall in Bulk, I hope, not altogether without its Uſes. For as it may be of Service, at leaſt to thoſe who have now, for ſome Time paſt, taken Pains in obſerving and collecting Foſſils, ſo it may contribute ſomething towards the Advancement of the Science it ſelf. For a right methodizing of natural Things, and a Diſtribution of each into their Claſſes, according to their natural Properties, and mutual Agreement amongſt themſelves, conduces very much to the more eaſy and certain Knowledge of them. For which Reaſon, ſeveral very learned Men of late Years, have happily imployed themſelves, and ſpent much Time and Labour, in reducing all Kinds of Animals and Vegetables into Method. But Foſſils, of however great Worth and Importance, have been much neglected, and left wholly to the Care and Treatment of Miners and meer Mechanicks. 'Tis on this Account that theſe, having not been yet ſufficiently made known and diſtinguiſh'd, have lain hitherto in the Dark; till being, Sir, at your Command, brought

brought forth to Light, I now diſplay, and lay all open to your View.

The Reaſon that there has been a ſo much greater Progreſs made in digeſting and methodizing Animals and Vegetables, is, that they are more frequently in View, better, and more readily known. For, in thoſe Bodies, the Marks and Characters, by which the principal Kinds, and ſubordinate Species are diſtinguiſhed, being ſo manifeſt and apparent, their Affinities or Differences may be diſcerned with Eaſe, and almoſt at firſt Sight. Whereas, Minerals are of a deeper, and much more abſtruſe and difficult Inquiry. Of this I ſhall produce one or two Inſtances. As the exterior native Complexion, in Samples of even the ſame Kind of Mineral, is commonly very different; ſo likewiſe muſt the interior Conſtitution be, by reaſon of the various extraneous Matter that is commonly incorporated with it in its firſt Concretion. Nor is there a leſs Diverſity in the Site of Minerals, their Place, and in the Variety

of Matter, among which they are found lodged and repoſited in the Earth.

THAT I might therefore the better extricate my ſelf from theſe ſo great Perplexities, and come to ſome Certainty in this Affair, I propoſed ſeveral Ways of Examination and Trial, in order to diſcover the Nature of ſuch Parts in theſe Bodies, as do not immediately fall under the Senſes. The firſt of theſe was, to find out and aſcertain the various Degrees of the *Hardneſs* of each. The next, to make accurate Obſervations of their various *ſpecific Gravity*. Finally, I tried each by *Fire*, and a *Chymical Analyſis*, in order to diſcover whether they would emit an *Halitus* or *Vapour*, or a *Smoke*, or a *Flame:* Whether they would yield an *Oil*, or a *Salt*: Whether they would be reduced to a *Cinder*, or a *Calx*: Laſtly, whether they would run into a *Vitrum*, or into ſuch a Maſs, as the Metalliſts are wont to call a *Regulus*. Beſides, as I am not forward to rely on my own Abilities, well knowing how little they are, I thought it proper, in ſo obſcure

ſcure and intricate a Subject, to confer with ſome others, who were well vers'd in the Knowledge of Minerals, particularly Mr. *Stoneſtreet*, whoſe Sagacity in ſearching into natural Things, and Succeſs in methodizing them, I had been long acquainted with. Neither would I, after all, have thus offer'd theſe my Attempts to a Perſon of your Judgment, without having firſt had the Approbation of thoſe others, who are moſt deſervedly in Eſteem for their Knowledge in theſe Studies. If I find what I have here laid before you be not unacceptable, as it will be the higheſt Satisfaction to me, ſo will it encourage me, if ever I am ſo fortunate as to have leiſure to lay before you, and, if it be ſo happy as to have your Approbation, to publiſh a Natural Hiſtory of all the Sorts of Foſſils, founded on Reflections made upon thoſe I have collected, and the Obſervations that I have made on others from abroad.

I am, *&c.*

LETTER II.

To Sir JOHN HOSKYNS Baronet.

The Study of Foſſils never hitherto reduced to Rule, nor any Form of Art. The Writers, both the Antients, and thoſe of later Times, have confounded Things buryed in the Earth, with the natural conſtituent Parts and Productions of it. Theſe diſtinguiſh'd, the Ranks of each adjuſted, and Foſſils *divided into* Extraneous *and* Native.

SIR,

I Have little to value my ſelf upon, beſides the Goodneſs I am perpetually receiving from my Friends, and the favourable Opinion they are pleas'd to entertain of my Studies. Nor does any Thing in Life afford me ſo ſenſible a Pleaſure, as the Reflection that I am able to do any Thing that is not thought wholly unworthy of Acceptance with Men of the

the Character of thoſe you mention. 'Tis particularly no ſmall Satisfaction to me, to be ſo far honoured with the Friendſhip of Mr. *Aglionby:* And, that a Man of his Goodneſs, and extenſive Knowledge, is pleas'd to think me capable of inlarging, or making any Addition to it.

But, Sir! you are, I am ſure, far from having any need to add that Motive: Or, to put his Commands into the Scale, when you well know of how much Weight yours alone ever are with me. And tho', if I conſider how great his Penetration, and yours is, I might be deterr'd from offering any Thing I am able to write to either, I am ſo far encourag'd by your joint Humanity, that without further Heſitation, I venture freely to lay before both, what comes readily into my Thoughts on the Subject He and You think, and indeed very juſtly, hath lain hitherto ſo much in the Dark.

The ſeveral Sorts of Matter, that conſtitute the terreſtrial Part of the Globe we inhabit, are uſually comprehended, and

and ſet forth by the Writers of Natural Hiſtory, under the general Name of FOSSILS.

THESE are of two Sorts, *extraneous*, and *native*. By *extraneous Foſſils*, I intend the various *vegetable Bodies*: As likewiſe the *Teeth* and *Bones* of *terreſtrial Animals*, and the Shells of *Oyſters*, *Conchæ*, *Cochleæ*, *Echini*, and other marine Creatures, that are found in great Numbers and Variety, buryed in all Parts of the Earth. Theſe, by moſt late Authors, have been ſuppoſed to be found in the Earth, and meer Stones; and treated of as ſuch, under the Names of *Oſtracites*, *Conchites*, *Cochlites*, and *Echinites*; which Names occurr very frequently in the Writers of Foſſils. And, by thoſe Names, ſometimes they deſign meerly the Shells above recited; ſimple, free, and empty: Sometimes thoſe Shells fill'd with Stony, Flinty, or other like Matter: Sometimes only the Stone, Flint, Spar, or other Mineral Bodies, that were originally formed and moulded in thoſe Sorts of Shells, ſince periſhed

and gone: Sometimes the meer Impreſſions of them in Stone: And not uncommonly, all theſe promiſcuouſly and indifferently. Which want of Care, and due Examination of theſe ſo different Bodies was indeed one great Cauſe that thoſe Writers fell into that Opinion. But the ſeveral *Sorts* of them are now rightly diſtinguiſh'd [a], and the *Origin* of each aſcertain'd [b].

I ſhall only add here, for the further clearing up of this Matter, the ſeveral fanciful Names that have been heretofore given to ſome of the moſt remarkable of theſe Bodies: And, from my own Obſervations upon them, note what they really are. That commonly call'd *Cornu Ammonis* [c] owes its Form to a turbinated Shell: The *Bucardites* [d], to a *Bivalve*. Indeed both of them are frequently found actually covered with the very Shells in which they were formed. That Body to

[a] *Catalogue of the Foſſils of* England, *&c.* M. S.
[b] Nat. Hiſt. *of the Earth. Part* 4 *and* 5.
[c] Plin. xxxvii. 10.
[d] Plin. ibid.

which Dr. *Plot* [e] has given the Name of *Thrichites*, is assuredly only Part of the Shell, of the *Pinna-Kind*, composed of transverse Parallel Fibres not unlike *Hairs* [f], which was the Reason that he confer'd that *Name* upon it. It is found very commonly, and in many Parts of *England*, besides *Shotover*, *Barton*, and the Places he mentions. The Figure of the *Hysterolithus*, of which *Ol. Wormius* [g], and several Naturalists since, have imagin'd such strange Things, is wholly accidental, and taken from a Species of that Kind of Shell to which *Fab. Columna* [h] has given the Name of *Concha anomia*; the Inside or Cavity of which this Stone is cast in, and exactly resembles. The *Brontia*, and *Ombria*, of *Geo. Agricola* [i], is an *Echinites*, and form'd in the Shell of the galeated *Echinus Spatagus*. So likewise are those of *J. de Laet* [k]; which he supposes to be also the *Che-*

[e] *Nat. Hist. Oxfordsh. c.* 5. §. 145. *Tab.* vii. *Fig.* 7. & *Nat. Hist. Staffordsh. c.* 5. §. 40.

[f] Θρίξ, *Hairs.*

[g] *Museum. p* 83.

[h] *De Glossopetra.*

[i] *De Nat. Fossilium. L.* 5.

[k] *De Gem. L.* 2. *c* 25.

Chelonites of *Pliny*. Thoſe two grav'd by *Fr. Lachmund* [l] are Stones form'd in a different Species of the *Echinus Spatagus*. That which *J. Kentman* ſent to *C. Geſner*, whereof he has given an *Icon* [m], is a Stone moulded in the Shell of an *Echinus Ovarius*. He has alſo the Figures of two Foſſil-Shells of the *Echinus Ovarius* [n], fill'd with Stone. Theſe he takes to be of that Sort that *Pliny* calls *Ovum Anguinum*. The very ſame *Ol. Wormius* has caus'd to be engrav'd under the Title of *Brontia* or *Ombria* [o]. Theſe Kinds of Stones the Country People here in *England* call ſometimes *Fairy Stones*, but commonly *Thunder Stones*; in which Fancy they agree with the People of *Germany* [p], and likewiſe with *Pliny* [q]. The Bodies call'd *Tecolithi* by *Pliny*, *Lapides Judaici*, and *Syriaci*, by other Writers, ſo much celebrated

[l] *De Foſſil. Heldeſhem. p.* 3.
[m] *De Figuris Lapid. p.* 61.
[n] *ibid. p.* 168.
[o] *Muſæum L.* 1. §. 2. *c.* 12.
[p] Carmina ex eo nomen invenit quod cum Fulmine, ut credit vulgus cadit. *G. Agrico. de Nat Foſſ. L.* 5.
[q] *L.* 37. *c.* 10.

brated by the antient Phyſicians for their diuretic Properties, but reputed by all as no other than meer Stones, have been at laſt publickly demonſtrated [r] to be only *elevated Spikes* of *Echini Ovarii*, brought forth of the Sea at the Deluge, and buried, together with other marine Bodies, in earth. The *Trochi*, *Trochitæ*, and *Entrochi*, as alſo the *Aſteriæ*, are now finally known to be all likewiſe owing to the Sea [s]. All the ſeveral Kinds of each ſerve as Cords or Strings to tie the Train or *Cauda* of that ſurprizingly ſtrange Body the *Stachyoides* [t] to the Shell of the Fiſh to which it belongs, and ſerves as a Train and Rudder for Steerage. This *Train* has its Name *Stachyoides*, from its reſemblance of an *Ear* of *Maize*, or *Indian Corn*. 'Tis found commonly among Shells, and other Remains of the Sea, in ſeveral Parts of *Germany*: And Mr. *Roſinus* of *Munden* has ſet forth a Diſcourſe [u] concerning it. I have frequently met with *Parts* of it in *England*,

[r] Greſham *Lecture, read* May 9. 1693.

[s] Greſh. *Lecture* 1693.

[t] Στάχυς. *Spica.*

[u] De Stellis marinis, *Foſſil.* 4°. *Hamb.* 4. 1719.

England, chiefly in the Chalk-Pits in *Surrey* and *Kent*. Mr. *Roſinus* calls the *Stachyoides*, Foſſil *Sea-Stars*, I confeſs I cannot imagin for what Reaſon. The *Parts* and *Segments* of theſe Bodies have obtain'd various Names among the Writers of *Foſſils*, e. gr. *Eucrinos*, *Pentacrinos*, *Pentagonos* [x]. The Bodies call'd by Mr. *Lhwyd Stellariæ* [y], are no other than Parts of the *Stella Arboreſcens*. The *Gloſſopetræ* are Teeth chiefly of *Sharks* of various Kinds. The *Plectronita*, or *Roſtrage* of Mr. *Lhwyd* [z], is the Tooth of a ſtrange Sea Fiſh, not nam'd nor deſcrib'd by the Writers of Fiſhes. There is in my Collection, a Jaw of this Fiſh digg'd up, with Teeth of this Kind ſtill actually remaining in it. The *Bufonitæ* are Teeth of the *Wolf-Fiſh* digg'd up in many Countries, along with other Spolia of the Sea. Theſe were wont formerly to be worn in Rings, and pretended to have grown in the Heads of *Toads*, whence they had the Name of *Bufonii*,

[x] Lachmund. de Foſſil. Hildeſhem. *Sect.* 3. *c.* 17. 18.

[y] *Lithol. Brit. Tab.* 14.

[z] Lithophylacium Britan. *Tab.* 16.

Bufonii, and great Virtues aſcrib'd to them. Dr. *Merret* [a], comparing theſe with thoſe in the Jaws of that Fiſh, found an exact Agreement betwixt them, and rightly concludes both to be of the ſame Origin. By this Method he imagin'd he had made a Diſcovery of a Counterfeit and Impoſture of the *Lapidaries* in ſelling *theſe Teeth* for the true *Toad-Stones*; ſuſpecting them to be really taken forth of the Jaws of that Fiſh, and not out of the Heads of Toads, he ſeeming not to have known that there are naturally no ſuch Stones in the Heads of Toads, that theſe are really all of them Teeth of the *Wolf-Fiſh*, tho' thus found in the Earth; and therefore, by thoſe who know not how they came there, reputed natural Stones. The *Siliquaſtrum* [b] is evidently a bony Subſtance, and by its Shape and Make appears to have ſerv'd for Coverture and Guard of the Palate of ſome Fiſh, that feeds, as ſeveral do, upon Shell-Fiſh.

[a] Pinax Rerum Nat. Britan. *p.* 210.

[b] *Mr.* Lhwyd *Philoſ. Tranſ.* N°. 200. *and Lithophyl. Brit. p.* 73.

Fiſh. The *Ichthyoſpendyla* [c] are only vertebres or Joints of the Back-Bone of Sharks, and other Fiſhes. The *Turcois*, that hath paſſed currently thorow all Ages for a meer Stone, is indubitably of *Animal Origin*. The various Samples of it that I have ſeen, are ſome of them Fragments of very firm hard Bones, the reſt of Teeth, that have imbib'd a Tincture in the Earth, either a dusky Blue, or a greeniſh. The Teeth of various Kinds of Sea-Fiſhes, and of amphibious Creatures, as the *Roſmari*, or *Morſe*, the *Manati*, and of *Elephants*, left at Land at the Deluge, are ſometimes found in digging, both here and Abroad; of which I have various Samples in my Collections. They are nearly of their Native Complexion, where they have not been lodg'd among mineral Matter, that being inſinuated into them has ſuperinduced and imparted to them its own Colour. Thoſe lodg'd where there is *Copper* in the Earth, are frequently *blue* or *green*, which Colour that Metal is wont to impart,

[c] Lhwyd Lithophyl. *Tab.* 18.

part, when insinuated in due Quantity. Nay, even when in less Quantity, so that the Body is of its native pale Hue, if exposed to the Heat of a Fire, to fetch forth the latent Copper Particles, it becomes of a slight *Blue*, or a *Green*. To the Bones and Teeth digg'd up out of the Earth, that retain'd much their native white Colour, or were a little variegated with Black, which all the Fossil Elephants Teeth, that I have seen, are, the antient Naturalists gave the common Name of Ελεφας ὁ ορυκτὸς [d], *Ebur Fossile*. To those that had acquired in any Part a bluish Colour, they gave the Name of *Calais*; which, as shall be shewn by and by, is what the later Writers call the *Turcois*. Dr. *Poterius* [e], finding out that the *Turcois*, which *Signior Pozzo* shew'd him at *Rome*, were really Ivory, tho' disguis'd by the Colour, suspected them to be, because not of real stony Constitution, all counterfeit; which was the very Oversight that Dr. *Merret* fell into in relation to the Bufonites. As these Teeth and Bones

[d] Theophrast. de Lapid. [e] Pharm. Spagyr. *L.* 2. *c.* 25.

Bones acquire a Colour by a *long* Stay in *cupreous Earth*, they attain it in a much *ſhorter*, by their lying in *cupreous Water*; this ſerving *quickly* to introduce the metallic Corpuſcles. Such there are in my Collection, taken out of the Currents of Water that flow forth of the *Copper Mines* of *Herugrundt* in *Hungary*, and of *Goldſcalp* in *Cumberland*. Tho' *F. Hardouin* [f] doubts of that, *Salmaſius* [g], and *Johan de Laet* [h], who had both of them much better conſider'd, and been more converſant with Foſſils than that learned Critick and Commentator, take the *Callais* of the Antients for our *Turcois*; and, I think, with very good Reaſon. *Plin.* L. 37. c. 33. *Callais e viridi pallens, fiſtuloſa, & ſordium plena, —leviter adhærens, nec ut agnata Petris, ſed ut appoſita, —fragilis. Optimus color ſmaragdi.* 'Tis not poſſible any Deſcription ſhould better anſwer the *Turcois*; which being a Tooth or Bone, that has lain long in the Earth, muſt

[f] *Not. in Plin.* xxxvii. 33.
[g] *Exerc. ad Solin.*
[h] *De Lapid. & Gem. L.* 1. *c.* 25.

needs be ſofter and more *brittle* than real Stones, as alſo *foul*, as being ſomewhat *porous*, which Teeth and Bones naturally are. Nor can it be *united, and of a Piece with the Rock*, wherein 'tis only lodged, but *ſlightly adhering* to it. Then the *Callais* was found in the ſame Places, where we find our *Turcois*. As to the *Colour*, *Pliny* repreſents it here like that of the *Emerald*; by which *Cæſalpinus* ſhews [i] he means a *Sky-Colour*, or *Blue-grey*. *Pliny* elſewhere [k] repreſents the *Callais* as nearly approaching the *Sapphire*, but paler, and of a *Sea-Green*; which exactly ſuits the *Turcois*. And *Salmaſius* well obſerves, that the very *Name* ſhews it to be of a *purpleiſh* [l], or blue Colour. The *Hammites*, compoſed uſually of multitudes of ſmall globular Bodies, is wholely made up of a *Congeries* of the *Veſiculæ* of the *Ova* of various Kinds of *Fiſhes*, fill'd with a fine hard arenaceous Subſtance. That they reſembled

[i] *De Metallis L.* 2.

[k] *Nat. Hiſt.* xxxvii. 56. Callais Sapphirum imitatur, candidior, & litoroſo mari ſimilis.

[l] Καλλαΐον *Exerc. in Solin.*

bled thoſe *Ova*, was indeed very early taken notice of [m].

THOSE, which I have been hitherto diſplaying before you, Sir! are the chief Particulars, I would note to you relating to the *extraneous Foſſils:* And as to the *Native*, the Writers having been ſo little accurate as, you ſee, to confound Bodies of ſo very different Origin and Conſtitution with them, it cannot be thought ſtrange, that their Accounts of the *native Foſſils* themſelves ſhould be frequently erroneous and imperfect. In aſſigning their very Names, they give us commonly the ſame Body under different Names; as they do different ones under the ſame Name. Then in their Methodizing and ranging of the native Foſſils, 'tis no wonder that they fail, and that all Things are in Diſorder, and out of Courſe with them, when they ſo frequently make Choice of Characters, to rank them by, that are wholely accidental, and unphiloſophical; as having no Founda-

[m] Hammites Ovis Piſcium ſimilis eſt, *Plin. Nat. Hiſt. L.* 37. *c.* 10.

tion in Nature, or the Conſtitution of the Bodies themſelves. Thus ſome rank them under the Heads of *common*, and *rare*, of *mean* and *pretious*: of leſs, and of greater *Uſe*. Then they reduce them to *ſubordinate Claſſes*, according to their particular *Uſes*, in Medicine, Surgery, Painting, Smithery, and the like; which would be proper in an Hiſtory of *Arts*, or *Mechanics*; but ſerves only to miſlead them and their Readers in the Hiſtory of *Nature*. Beſides, they rank, amongſt the reſt, Bodies that are Mineral indeed, but *factitious*, and not in their native Condition. An Inſtance of this we have in the *Pumex*, which almoſt all the Writers of *Stones* place amongſt *them*; whereas 'tis in Reality nothing but a *Slag* or *Cinder*, found either where *Forges* of Metalls have antiently been; or near *Ætna*, *Veſuvius*, or ſome other burning Mountain, forth of which it has been caſt. Another Example of this we have in the *Lapis Spongiæ*, which is a light, poroſe, friable Body, compos'd of a Matter chiefly *Corallin*, and generally made

made into the Form we find it, by a *marine Inſect.*

But theſe are only a few of the many Inſtances that might be alledged to evince in how uncertain and perplex'd a Condition this Study has hitherto lain: And how little Light into the Nature of Foſſils, and their Relation to one another, we are to expect from thoſe that have heretofore wrote. The claſſical Diſpoſal of the native Foſſils will indeed ever be a Work of Difficulty. It hath been prov'd from Obſervations [n], made on the preſent Condition of them, that they have been once all in a State of Solution and Diſorder: And ſuch is the preſent Conſtitution of them that it is very hard, if not impracticable, to rank and reduce them into an exact Method [o]. For they want thoſe fix'd Characters of Affinity or Diſagreement that Animals, and that Vegetables carry along with them. It hath been ſhewn, how little Certainty there is in their Colour and Figure, in their

[n] *Nat. Hiſt. Earth, Part* 2.

[o] *Vid. Nat. Hiſt. Earth, Part* 4. ſub initio.

their Situation in the Earth, and their Mixtures with each other [p]. And few of them being pure, or unmix'd, 'tis plain there can be no determinate Rule as to their *ſpecific Gravity*, their *Conſiſtence*, or Approach more or leſs to *Solidity*, or as to their Conſtitution. In fine, there being no ſingle Character ſteady, or to be rely'd upon, I am oblig'd to make Uſe of one or other of them, as I ſee moſt fit, and conducing to my Purpoſe. My chief Regard is, to the Nature and *conſtituent Matter* of each; but ſince that Matter is frequently mix'd, and various in the ſame Sort of Body, I conduct my ſelf by ſuch other *natural Notes* as preſent themſelves, and all ſuch *Teſts* and *Methods of Scrutiny*, as I find practicable. In particular, I have Regard to the *Bulk* each Sort of Foſſil is naturally of: Alſo to its comparative *Gravity*, *Denſity*, *Solidity*, the *Groſſneſs*, *or Fineneſs* of the Parts: The natural *Figure* of the form'd Stones, and other Bodies, their *Texture* and *Conſtitution*; as likewiſe

[p] Ibid.

likewiſe the *Colours* obſervable in many Sorts of Foſſils, the *Diaphaneity*, or *Opakeneſs:* Their Diſpoſition to a *Solution* and Mixture with Water. Laſtly, I conſider in what Manner they affect the Organs of Senſe, the *Smell* and the *Taſte;* as alſo the *Touch*, as to their Roughneſs, Harſhneſs, Smoothneſs, and their being unctuous, oyly, and the like. With this Conduct, and aſſiſted by theſe Lights, I range the native Foſſils in the following Method. 1. *Earths.* 2. *Stones.* 3. *Salts.* 4. *Bitumens.* 5. *Minerals,* or Bodies nearly approaching the Nature of Metalls. And, 6. *Metalls* themſelves. The particular Reaſons for my adjuſting them thus, you will be better Judge of, when you come to ſee the Detail of the whole Method.

I am, Sir, *&c.*

LET-

LETTER III.

To the ſame.

Of the Ceraunіæ, *or* Stone-Weapons, *the* Magical Gemms, *and ſome other* artificial Things *antiently in Uſe, imagin'd by many late Writers to be* natural: *With* Icons *of ſeveral of thoſe in my Collection, brought from moſt Parts of the known World.*

SIR,

IT muſt be allow'd, that I had the more Reaſon to attempt the *Natural Hiſtory of the Earth*, and of the Bodies found in it, both *native* and *extraneous*, becauſe, as you obſerve, this Study had all along lain in the greateſt Darkneſs and Confuſion: And, to the very Time that I ſet forth that Work, it was *not yet agreed among the Learned, whether theſe Bodies formerly call'd* Petrify'd Shells, *but now-a-days paſſing by the Names of formed Stones*,

Stones, be original Productions of Nature, form'd in Imitation of the Shells of Fishes, or the Shells themselves [p]. Indeed the latest Writers of all were positive that these Bodies were not *real.* Dr. *Lister* [q] asserts point blank they were *never any Part of an Animal,* being only *Resemblances of Shells,* but *meer Stones,* which the *Earth produces,* and each *shap'd by the Power inherent in the Stone,* or in it self. This must needs be allowed by all who have made any Observations of the Productions of Nature in the Formation of Bodies, tho' they have not made many Observations on these, to be a Doctrine, however positively delivered, very mysterious and paradoxical. Be that as it will, not only Dr. *Lister,* Dr. *Plot,* and others here, but learned Men Abroad, fell generally into it. Nay, so Zealous were they bent upon it, and strongly possessed with it, as to imagin not only the animal and vegetable Bodies, found lodg'd in the Earth, but several

[p] *Mr.* Ray's 3 *Discourses* 8°. Lond. 1693. *p.* 127.

[q] *Philos. Transf.* N°. 76. *Cont. Lib.* Cochlitarum Angliæ 4°.

artificial Things, antient *Urns*, and other *Vaſes*, *Stone-Weapons*, and *Magical-Gemms*, to be productions of it, and formed by Nature under Ground; which may paſs for one of the many ſurprizing Inſtances there are of Precipitation, Credulity, and want of Judgment in theſe Writers; and I wiſh there were not ſo many likewiſe in all the other Parts of natural Hiſtory; that a Man that would be accurate in any, can hardly tell what to rely upon, without bringing all, of the very much that hath been written, to the Teſt anew. I have formerly had Occaſion to make ſome Reflections on the Notion [r] of the *Foſſil-Urns*; and ſince I have your Commands for it, I ſhall here offer ſomething concerning the Antient *Magical Gemms*, and *Stone-Weapons*.

Dr. *Liſter* [s] ſuppoſes theſe Gemms to be *Ombriæ*; and with his uſual Warmth and Poſitiveneſs, pronounces them *figur'd*

[r] *Nat. Hiſt.* Telluris defenſa contra Camerar. *p.* *and Mr.* Holloway's *Tranſlation*, *p.* 154.

[s] Philoſ. Tranſ. N°. 201.

gur'd naturally, and without any Artifice: Nay, and which is a very pretty Fancy, *naturally poliſh'd too*, with juſt as much Reaſon as he might a *Table Diamond*, a *Brillant*, or an *Intaglia* of *Julius Cæſar*. But you know, Sir! this learned Gentleman having ſet forth in his Youth, with the Notion, that all Bodies of regular and determinate Figure, found in the Earth, were form'd there, abid by it ſtifly to the End; this being the very laſt Paper he publiſh'd on this Subject. Writers for Fame, great Souls! are ever conſtantly in the Right, and will ſooner give up their Lives than their Opinions; even tho' they firſt take them up frequently upon meer Fancy, or very ſlight Grounds; while thoſe, who really ſearch after *Truth*, are very wary in what they advance; and with great Readineſs and Candor ſubmit all to the ſtricteſt Scrutiny, attending as well to every Thing that may be offer'd againſt it, as for it. As to the Bodies you are ſo deſirous of an Account of, they have paſs'd from the remoteſt Antiquity downwards, under the Notion and Title of

Magical-Stones, or *Gemms*. They are, to this Day, ſometimes found broad in our fields. I have ſeen only three Kinds of them, and keep a fair Sample of each in my Collection. Neither any other Writer, nor Dr. *Liſter*, mentions any more: And his are indeed the ſame with mine; ſo that I am apt to believe there are no more. My firſt is, of an exactly ſphærical Form, near two Inches in Diameter. The ſecond is a *Sphæroid*, much compreſs'd, 1 Inch $\frac{4}{10}$ in Diameter, and $\frac{7}{10}$ in Perpendicular. The third is oblong, round off at each end, with a Baſis ſomewhat convex, and two Sides alſo a little ſwelling and convex, the upper Part terminating in a Ridge. This Stone is two inches in Length, and $1\frac{3}{10}$ in Diameter. 'Twas found near *Barkhamſtead* in *Middleſex*, and poſſeſs'd long, indeed to his Death, by an eminent Phyſician there. 'Twas made uſe of by him as a *magical Speculum*; he giving out to his Patients, that *Something* was wont to *diſcover* it ſelf to him in *this Stone*, by which he receiv'd Light and Informations, on ſuch Occaſions as he inſpected and conſulted it.

He

He left a great *Eſtate* to his *Son*; who not being ever able, with both his Eyes, to diſcover that *Spectrum*; inſtead of getting an *Eſtate*, ſpent the greateſt Part of that which his Father left him; and was pleas'd to do me the Honour to ſend the Stone to me, who being not ſo happy as to be poſſeſs'd of *Faculties* equal to thoſe of the wiſe good *old Gentleman*, can no more diſcern the *Spectrum*, nor get an *Eſtate* by it, than the generous frank young Gentleman his Son could.

THESE three Stones are all form'd out of that Sort that the Lapidaries call *Peble-Cryſtal*; which is found in ſeveral Parts of *England*; and are very fair, pellucid, and clear. The firſt is indeed of a fine deep Water, and is a very beautiful Stone; being of a ſphærical Figure, it might be taken for a *Pearl*: And Dr. *Liſter* [t] ſays, that theſe are *call'd in ſome antient Leaſes, Mineral-Pearl.* In former Times, they muſt of Courſe be, before

[t] Ibid.

fore they were pick'd up, more frequent, particularly in *Britain:* And 'tis not altogether improbable, that theſe are of thoſe mention'd by *Suetonius* [u] as found antiently here, and ſuppos'd by the *Romans* to be *Pearls*, but of an *extraordinary Bigneſs* [x]; theſe being indeed vaſtly more large than any of the true *Pearls*. moſt of theſe Stones, and particularly the three above mention'd, are ſo regularly cut, and poliſhed in a manner ſo exquiſite, that I can hardly imagine how a people ſo barbarous, and deſtitute of all Working-Tools, [y] could ever finiſh them with ſo great Elegance and Exactneſs. When firſt I obſerv'd theſe Stones, I conjectur'd they might be us'd meerly as *Gemms*, and worn antiently for Ornament by the Natives. But Mr. *Aubrey*, who, you know Sir! hath much ſtudyed the Antiquities of this Iſland, contends that they were us'd in *Magick* by the *Druids:* And, in his *Miſcellanies* [z], he takes notice of a *Cryſtal Sphære*, ſuch as the firſt of theſe is, or *mineral Pearl*, *us'd*

[u] *In Cæſare* §. 47. [x] Sueton. Ibid. [y] *Conf. State of* London, 8°. §.—— [z] 8°. Lond. 1696. Page 128.

us'd by Magicians, and *to be inſpected by a Boy.* But, long before him, *Joach. Camerarius* [a] *mentions a round Cryſtallin Gemm*, into which a *chaſte Boy* looking, diſcern'd an *Apparition*, that ſhew'd him any thing that was required or ſought for. *Paracelſus* [b] carries the Thing further, and avers, that in theſe *ſpecula are ſeen Things paſt, preſent, and to come:* And that ſome *Star impreſſes on the Cryſtal an Image of its Influence, and a Similitude of the Thing inquired and look'd for in it.* And of this Sort were the Cryſtallin Stones made uſe of by Dr. *Dee*, and Mr. *Kelly* in their myſterious Viſions and Operations; of which they drew up a *Journal*, ſince publiſh'd by Dr. *Meric Cauſabon* [c]. One of theirs was *round, of a pretty Bigneſs*, and of *Cryſtal*; very probably the ſame with my firſt. This they call the *Shew-Stone, and Holy-Stone.* You ſee, Sir! from theſe Fooleries having held and been kept up thus, from the moſt early Times, in a continued

[a] *Præf. in* Plutarch. de Defectu Orac.

[b] *Explic. Aſtron.*

[c] *Relation of Dr.* Dee, *&c. Fol.* London 1659.

nued Tradition, quite down to our own, while Things the moſt highly rational have been neglected, dropp'd and fallen into Diſuſe, how fond Mankind hath ever been addicted and prone to Superſtition; of which there are but too many other Inſtances.

As to the Antients, from the Writers of thoſe Times, we learn, that the *Zoraniſcos* was a *Gemm* us'd by the *Magi* [d], as alſo the *Heliotropium* [e]; with a great Number of others, not needful to be recounted here. Thoſe which come the neareſt to ours, and from which the ſuperſtitious Uſe of theſe ſeems to be derived, are of the *Star-Stone*, or Aſtroite Kinds. Not of thoſe of the later Naturaliſts, which had their Names from their Figure, or ſome Delineations upon them, reſembling the Stars of Painters and Heralds, but of thoſe of the Ancients which were lucid and tranſparent; and therefore were ſaid to *ſhine like a Star*, whence they had their Name.

—Καὶ

[d] Zoraniſcos Magorum Gemma. *Plin.* xxxvii. 10.
[e] Ibid. xxii. 29.

——Καὶ ὰ σκοπιὰς παλλήνης
φύεται Ἀσέριος, καλὸς λίθος, ὅια τις Ἄσυρ
Μαρμαίρων [f].

In like Manner the *Star-Stone* of *Pliny* was white, or nearly approaching the Tranſparency of *Cryſtal*, and ſuppoſed to have its Name from *reflecting back the Light of a Star, when expoſed to it* [g]. The ſame Author treating, if not of this, of a nearly related Species of *Star-Stone*, which he ranks likewiſe amongſt the tranſparent Gemms, tells us that 'twas in *mighty Eſteem*, and that *Zoroaſter*, one of the moſt celebrated of all the *oriental Magi*, *had ſet forth its wonderful Efficacy* in *magical Arts* [h]. The ſame Author obſerves, that the *Aſteria* was a pretty hard Stone, and that the Lapidaries found ſome Difficulty in the cutting

[f] Dionyſ. περιηγ. 327.

[g] Candida *eſt* vocatur Aſterios, Cryſtallo propinquans, in India naſcens, & in Pallenes Littoribus— Cauſam Nominis reddunt quod Aſtris oppoſita Fulgorem rapiat ac regerat. *Plin.* xxxvii. 9.

[h] Celebrant & Aſtroitem, miraſq; Laudes ejus in Magicis Artibus Zoroaſtrem ceciniſſe. *Plin.* xxxvii. 49.

of it; which is likewiſe the Caſe of theſe Stones. So that thoſe of the Antients apparently agree with theſe as to their Conſtitution, their Complexion and Diaphaneity, as well as the ſuperſtitious Uſes they were applied to: And I take notice of one Species of *Star-Stone* in the ſame Author, that was likewiſe *orbicular*, and of the very ſame Shape [i] with the firſt of mine. I'm not a little diſpleas'd with my ſelf, that I have, before I was aware, taken up ſo much of that Time which, Sir, you know ſo well how to imploy better, and run on thus far on a Subject ſo very ſlight. But I ſhall diſmiſs it, after I have offer'd you a Conjecture at the Reaſon why this Kind of Stone has been employ'd thus as a *Speculum*, and turn'd to Magical Deluſion, and the ſpying out of *Spectra*. It moſt probably happen'd from the *Conſtitution* of the Stone; which, in every various Poſition, gives a various Coruſcation, and Glare of the Light; and, by that Means, a various Repreſentation of Things

[i] Sideritis— Globoſa Specie. *Plin.* xxxvii. 65.

Things, and Entertainment of the Fancy. Which Conjecture I am led into by their own Deſcriptions and Accounts; wherein they ſet forth the *Glittering and Light* of the Star-Stone, which they compare ſometimes to that of the *Sight of the Eye*, ſometimes to *the Moon at full*; and take notice beſides, of its reflecting the *Light* of a *Star*, or of the *Sun*, when expoſed to either [k].

In like Manner the *Selenites*, or *Moon-Stone* of the *Antients* was *white*, or *tranſparent* [l], and had its Name from repreſenting the *Moon*, as in a Glaſs, as *Pliny*, *Geſner* [m], *Agricola* [n], and Dr. *Plot* [o] obſerve; tho', for the ſame Reaſon, it might as well have been call'd the *Sun-Stone*, it as readily repreſenting that, or any other luminous Body; and therefore had likewiſe the Name of *Lapis-Specularis*, as Dr. *Plot* takes Notice. And as the *Aſtroites* was uſed in Ma-

 gick,

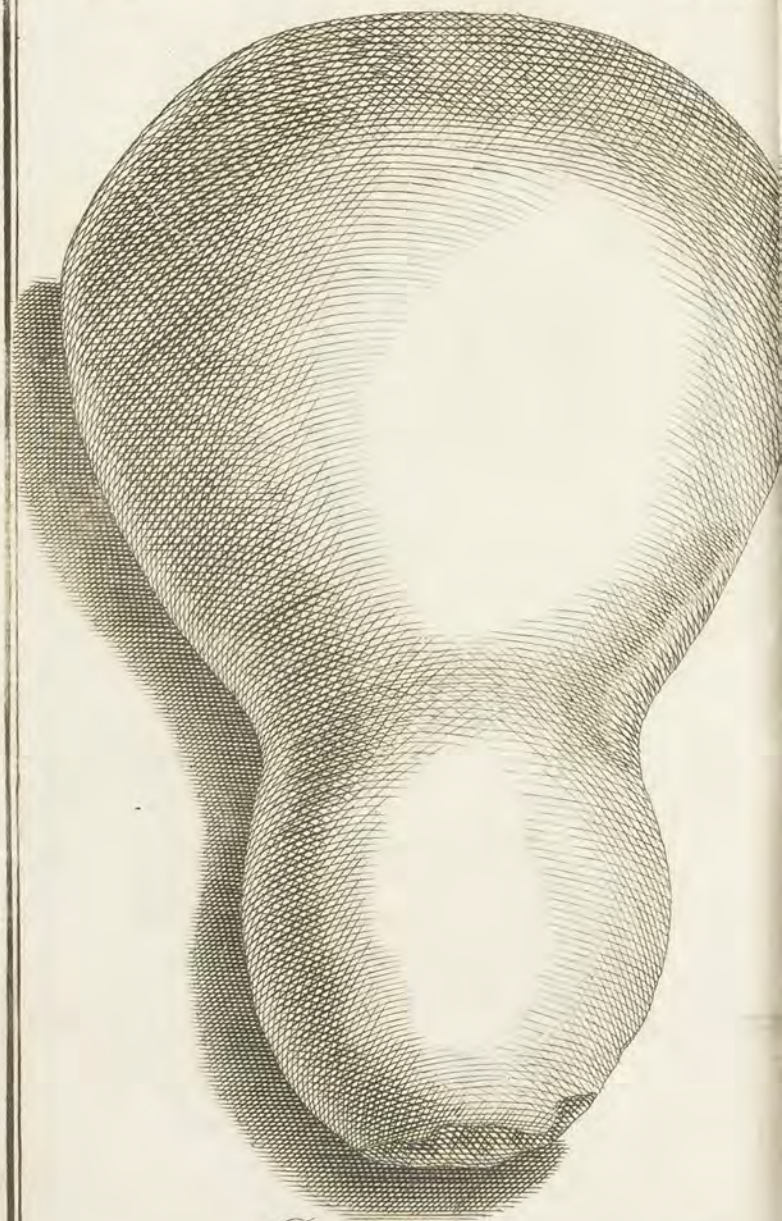
[k] *Plin. L.* 37.
[l] *Plin. ibid.* & Dioſcorid. ὑλης ἰατρ. v. 159.
[m] *De Fig. Lapid.*
De Nat. Foſſil. L. 5.
[n] *Nat. Hiſt. Oxf. c.* 5.

gick, amongſt the *Antients*, ſo the *Selenites* was uſed by them as a *Charm* or *Amulet* [p].

You'll imagine, Sir! treating of theſe Things, 'twill not be eaſy for me, not to recollect the ſo juſtly celebrated and illuſtrious *Oracle* of the *Jewiſh Nation*, that paſs'd among them, under the Name of *Urim and Thummim*, or *Lights* and *Perfections*, for ſuch thoſe Words import. This was compoſed of *twelve Gemms*, artfully join'd together, and worn on the High-Prieſts *Pectorale*. 'Tis thought, whether rightly or not I take not upon me here to determine, by the beſt Judges of the *Jewiſh* Antiquities, that thoſe who conſulted this *Oracle*, looking intenſly upon it, receiv'd Anſwers and Reſolves by ſome new and unuſual *Lights* and Irradiations then miraculouſly exerted and caſt forth by thoſe *Gemms*. The *Fame* of a Thing ſo ſurprizing and extraordinary could not but paſs Abroad to the neighbouring Oriental Nations; and

[p] Φυλακτήριον, πετάλλμα. Dioſcorid. *L. c.*

Fig. 2. *P. 37*



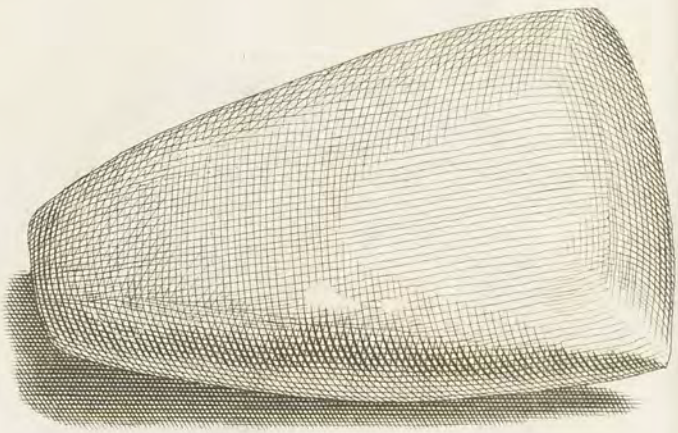
Part 2.

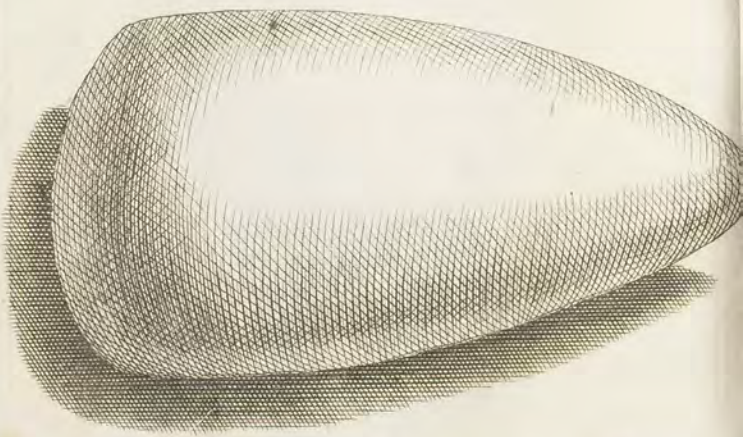
Fig. 4. P. 37

Part 2.

Fig. 3.

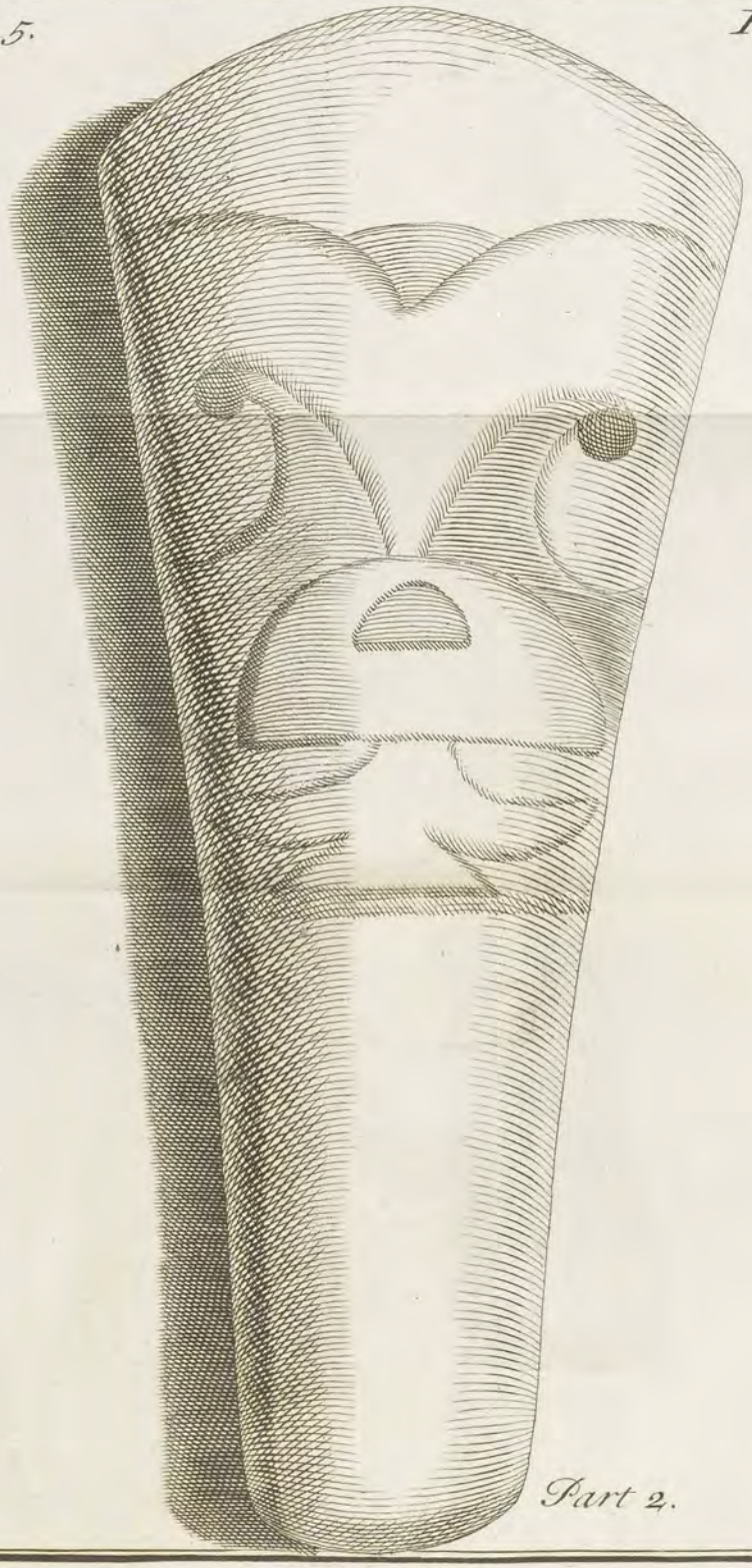
P. 37





Part 2.

Fig. 5. P. 37.



Part 2.

and 'tis not wholly improbable, that the *Zoroaſtrian*, and other like *Gemms*, were made in Imitation of this, and took their firſt Riſe from it. 'Twill not be thought Strange, that they ſhould all differ ſo much from this, when 'tis known that the *Jews* treated all the other Nations in a manner very ſupercilious, and were ſhy of imparting any Thing to them; ſo that the Tradition and Account they receiv'd of it muſt needs be very lame and imperfect.

I come next, Sir! in Purſuit of your Commands, to give ſome Account of the *Stone-Weapons* and *Inſtruments*. Now, tho' theſe carry in them ſo plain Tokens of *Art*, and their Shapes be ſuch as apparently to point forth, to any Man that rightly conſiders them, the *Uſe* each was deſtin'd to; yet ſome of the Writers of Foſſils, and of great Name too, have been ſo ſanguine and haſty, ſo much blinded by the Strength of their own Fancy, and prepoſſeſſed in Favour of their Schemes and Notions, that they have ſet forth theſe Bodies as natural Productions

of

of the Earth, under the Names of *Ceraunia*. Of this Sort are the *Ceraunia* of which we have *Icons* in *C. Geſner* [q], *A. Boetius* [r], *M. R. Beſler* [s], *Ol. Wormius* [t], *S. L. Moſcardi* [u], and *Fr. Lachmund* [x]. And *J. Kentman* [y] hath left us a Deſcription of four of theſe, likewiſe, under the Names of *Ceraunia*. The Authors here recited, imagine theſe to be the *Ceraunia* of the *Antients*. Probably they may be thoſe of *Sotacus* [z]; but what the *Ceraunia* of *Pliny* were, it is not eaſy to conjecture from his Account of them [a]. He ſuppoſes them to fall with *Showers* and *Thunder*. As he does likewiſe

[q] *De Tig. Lapid. p.* 62. 64.

[r] *Hiſt. Gem. L.* 2. *c.* 261.

[s] *Gazophyl. Rer. Nat. Tab.* 34.

[t] *Muſæum. L.* 1. *Sect.* 2. *c.* 12.

[u] *Muſæo Moſcardo L.* 2. *c.* 50.

[x] *De Foſſil. Hildeſhem. p.* 23.

[y] *Nomenclat. Foſſil. Miſniæ p.* 30.

[z] Sotacus & alia duo genera fecit Cerauniæ, nigras rubenteſq; ac ſimiles eas eſſe *Securibus*; per illas quæ nigræ ſunt & rotundæ Urbes expugnari & Claſſes, eaſque *Betulos* vocari: quæ vero longæ ſunt, *Ceraunias*, Plin. *L.* 37. *p* 737.

[a] Eſt inter candidàs & quæ *Ceraunea* vocatur, fulgorem ſiderum rapiens. Ipſa Cryſtallina ſplendoris cœruleî. *Plin. L.* 37. *p.* 737.

wiſe the *Ombria*, and *Brontia* [b]: Of the *Ombria* he gives no Deſcription, and a very obſcure one of the *Brontia*; he only comparing it to the *Head* of a *Tortoiſe* [c]; as he does alſo the *Chelonitis* [d].

THE *Stone-Weapons*, and *Inſtruments* were all cut out, and made, before the Diſcovery of Iron. But, when once this Metal was brought to Light, and its *Uſes* known, 'twas found ſo much preferable in every Reſpect, that thoſe Stones were preſently caſt away: And they are thoſe which we ſtill ſometimes find Abroad in the Fields, not only here in *England*, but in *Scotland* likewiſe, and *Ireland*, and *Germany*, and ſeveral other Countries; where they ſerv'd, in the moſt early Ages, for Axes, Wedges, Chizels, Heads of Arrows, Darts, and Lances. Nay, among Nations yet barbarous, and unacquainted with the Manufacture of Iron, and that have not been diſcover'd by

[b] Ombria ſicut Ceraunia, & Brontia cadere cum Imbribus & Fulminibus dicitur, *Plin. L.* 37. *c.* 10.

[c] Brontia capitibus Teſtudinum ſimilis *Plin. L.* 37.

[d] Chelonitides teſtudinum ſimiles. *Plin. L.* 37.

by the *European* Navigations, till of late Years, these *Stone-Weapons* and *Instruments* are in Use to this Day; e. gr. in the Island of *Guam*, one of the *Ladrones*, and in *Nova-Britannia*, an Island lying *South* of the *Æquator*, and the farthest East of any yet known, discover'd a few Years ago by *Captain Dampier*. Indeed, when the *Spaniards* made their first Descent upon *America*, they found no *other* amongst any of all the Nations of that vast Continent, or the Islands adjacent. For, tho' the *Americans* had in many Parts *Iron-Ore*, very good, and in great Plenty, they knew not the Use of it, till they were taught that by the Spaniards. In my *Discourse of the Peopleing of America* [e], I have shewn, that *that Colony* was departed, and had left the *old World before Iron was found* out, and the *Uses of it known there*. They are so many and great, and this Metall of such Importance, that, had the *American* Colony been acquainted with it, before their

[e] *Of this there is since set forth a brief Extract.* Nat. Hist. *Earth illustrated.* p. 105. *& Seq.*

their Departure, they would never have again loſt or forgot it. Perhaps, Sir! you may ſay, that there were *Iron Inſtruments* in the World long before, even before the Deluge; which we learn from the Hiſtory of *Tubal Cain*, who was then *an Inſtructer of every Artificer in Braſs and Iron* [f]. Now theſe muſt be known to *Noah*, and all his Sons, by whom the *whole World* was peopled. But thoſe *Inſtruments* all periſh'd, and were deſtroy'd, during the *Deluge*. I have ſhewn elſewhere [g], that all *Metallic* and *Mineral Bodies* were then diſſolv'd: And, tho' it be there ſo clearly made out, from Obſervations, that none be ſtill wanting, this affords an *additional Proof* of the *Certainty* of *that Propoſition*. From the moſt indubitably authentick Monuments that can be required, we know that the *Uſe of Iron* was not recovered in *Aſia*, whence it paſs'd to *Europe*, and the reſt of the *Old-World*, till ſome *Ages after the Deluge*: Nor in *America*, till the *Spaniards* made their Deſcent upon it, two or three Centuries

O

[f] *Gen.* iv. 22. [g] *Nat. Hiſt. Earth. Part.* iv.

turies ago. And tho' *Noah* and his Sons could not but remember the Iron in Uſe *before the Deluge;* yet ſo great Havock and Devaſtation was made, during that ſo fatal and terrible Cataſtrophe, and ſo unhappy a Change in the Earth, that there was every where a new Face of Things, in which they muſt be much to ſeek, and reduced to the greateſt Diſtreſs, Exigence and Neceſſities [h]. They muſt, in ſuch a State, be fully taken up meerly in providing Food, and the common Supports of Life; and would have little leiſure to look after Arts, and Things of remoter Uſe, till Mankind were further multiplyed, and their Affairs on a better Foot. In this ſo calamitous a Condition, *Iron* might be perfectly *forgot*, and the Knowledge of it quite worn out.

'Tis remarkable, Sir! that, of theſe antient *Stone-Weapons* and *Inſtruments*, many are ſhap'd with great *Regularity* and *Art*, and finiſh'd with an Exactneſs very ſurprizing, conſidering they then had

[h] *Conſ. Nat. Hiſt. Earth. Part* 1.

had not the Aſſiſtance and Advantage of the *Tools* that we now have. The *Arrow-heads* are particularly remarkable. They are of a Form the moſt miſchievous, and fitted to hurt, that could be poſſibly deviſed. They are brought to an exquiſitely ſharp Point, keen Edges, and have Snaggs, or, as they are call'd, Beards, on each Side, on Purpoſe that they may make a large Wound wherever they enter, and not be drawn out again without much Difficulty and Harm to the Part in which they happen to be infixed. 'Tis further remarkable, that the *Arrow-heads*, found in Countries the moſt diſtant each from other, e. gr. *Britain*, and the Country bordering on the *Streights of Magellan*, are of the *ſame miſchievous Form.* 'Tis true, different Men having in View the ſame Deſign, conducting their Thoughts in a regular Manner, may come, in the Purſuit, to the ſame Concluſion; and, as in this Caſe, hit on the ſame Shape for a Weapon of ſuch Deſign. But it is much more likely, that they came all from the ſame Origin; and that the *firſt Module* was brought from

Babel, to the various Countries whither the ſeveral Colonies, ſent thence, made their Migrations.

Give me Leave, Sir! to take notice by the by, that ſome may perhaps think ſtrange, that ſuch a Building as that of *Babel* ſhould ever be ſet about by Men that had not the Uſe and Aſſiſtance of Iron. But this, like the other moſt antient Buildings of thoſe Parts, was of *Brick*; in which Iron Tools are not ſo needful as in Buildings of *Stone*. And yet I have Reaſon to believe, that the vaſteſt of this later Kind that the World ever ſaw, I mean, the *great Pyramid* in *Egypt*, was rais'd before the Managery of that Metall was again recover'd and found out. Be that as it will, 'tis moſt certain, that the Buildings, that the *Spaniards* found out at their firſt Arrival in *Peru*, were rais'd and finiſh'd wholly *without the Aſſiſtance of Iron*. And yet ſeveral of theſe were ſo magnificent, and ſome of the *Stones* ſo very *large*, as almoſt to amaze the *Spaniards*. What added to the Surprize, was, that all were very *regularly wrought*,

wrought, ſquared, and the Joints ſo cloſed and fitted, as hardly to be diſcern'd; in ſo much that the whole appear'd as if cut out of only one huge Maſs of Stone.

By Means of a Multitude of Hands, and united Strength, with continued Labour and Induſtry, a right Invention and Contrivance, Things ſurprizingly great have been perform'd even by Nations the moſt barbarous, ſavage, and wholly deſtitute of Inſtruments and Machines. As to thoſe Buildings, 'tis probable the *Peruvians* ſquared and ſmoothed the Stones by *rubbing* them againſt one another; and raiſed them up into their Ranks and Places by Aſſiſtance of *Heaps of Sand* or *Earth*, gradually piled up on the outſide of the Walls of theſe Buildings.

'Tis late: And, which, I fear, you'll but too eaſily collect from what, preſuming on your uſual Indulgence, I thus venture to ſend you, I am very ſleepy; which falls out the more fortunately to you, as it prevents your further Trouble.

I am, Sir, *&c.*

LET-

NUMBER IV.

An Extract out of the Preface *of one of the* Catalogues *of my Foſſils, containing* Directions for regiſtring of the native Foſſils, and compoſing an inſtructive and uſeful Catalogue of them.

THESE Foſſils ought firſt of all to be digeſted into Claſſes, and enter'd in a proper Series and *Method*, according to their mutual Relations and Alliances. Then the *Hiſtory* of each ſhould be given; ſo far as there can be any Knowledge or Information of it obtain'd; with an Account *where it was found*, at what *Depth* in the Earth, what *other Bodies* or *Matter* it was attended with, in *what Manner it lay*, whether in a *Fiſſure*, or in a *Stratum*; with all other Circumſtances of the Place. Next ſhould be noted every Thing obſervable in the Body it ſelf; its *Colour*, its *Figure*, *Texture*, or the Manner of the Concretion of

of the Parts; and the *different Sorts of Matter* that concur, and are united in the ſame Maſs. *Finally*, each ſingle Body ſhould be brought to the *Fire*, to *chymical Trials*, and all other Teſts; in order thorowly to diſcover its *Nature, Conſtitution, Properties,* and various *Uſes*. Was this once effectually done, and juſt *Deductions* and *Inferences* made from the Whole, 'twould go a great Way towards a *Natural Hiſtory of Foſſils, and* the perfecting this Knowledge. Of the great Profit and Uſefulneſs of theſe Studies to the Publick, I have ſpoke fully, and given many Inſtances elſewhere. What adds further to their Advantage is, that they are not only *entertaining and pleaſant*, but if the Compiler be accurate, they muſt be *clear* likewiſe, ſure, and little liable to Error and Impoſition. *Mathematical Propoſitions* are ordinarily abſtracted; require great Extent of Thought, and Application of Mind. Whereas theſe *Mineral Propoſitions* are plain, ſimple, and obvious. The Relations of the Site and Circumſtances of the Foſſils in the Earth, and of the various

various Experiments made upon them, are no other than ſo many *Hiſtories of Fact*. The Accounts of all Things obſervable in the Foſſils themſelves, will carry with them *Evidence of Senſe*, which is the *higheſt Certainty*. Theſe Foſſils will be ſo many ſtanding *Monuments*, that give *perpetual Atteſtation* to this: And there can need no other *Proof* of thoſe *Accounts* than only ſimple *View* of the *Things* ſet forth in the *Catalogues*. Nor, finally, can it be difficult to diſcern, whether the *Concluſions* drawn from thoſe Relations, Experiments, and Accounts, *follow rightly* from them, or not.

NUMBER V.

To Mr. ———

The Aſſiſtance that this, and ſeveral other learned Men have given to the carrying on the Deſign of the N. H. E.

SIR,

THERE are not many in this Age, who have taken the Pains that you have done, very happily and ſucceſsfully, in moſt Parts of uſeful Learning; but more particularly in the Study of the *Natural Hiſtory of the Earth*, and of *Foſſils*. The Example and Countenance of a Gentleman of your Diſtinction and right good Senſe, has been an additional Confirmation and Incitement of me; and the Communications that I have from Time to Time receiv'd from you, have given me no little Light and Aſſiſtance. Such Part of my Labours, as I have ſubmitted to the Judgment of the Publick,

have met with greater Oppoſition from ſome, they beſt know why, than I had Reaſon to expect. But when I conſider'd what it was that they urg'd, it rather afforded me Reaſon to believe what I was doing was right, and confirm'd me in the Purſuit of it.

Tu ne cede malis, ſed contra audentior ito.

I can eaſily paſs by Opinionatry, Ill-nature, and the buſy meddling of thoſe who thruſt themſelves into every Thing, how little Knowledge ſoever they may have of any Thing, while I have the Approbation of Men of your Candour and Accompliſhment. Nothing can give me higher Encouragement. 'Tis for the Satisfaction of ſuch only that I was concern'd: And, having attain'd that, I have my End. What you write in your laſt, *that having had Occaſion ſeveral Times to paſs and repaſs the* Alps, *where ſuch vaſt Tracts of the interior Parts of the Earth are diſplay'd, and laid open to view, and various Opportunities for ſeveral Years paſt,*

past, of making Observations in many other Places, you are perfectly convinc'd of the Truth of these Observations that I have publish'd in my natural History of the Earth: And that, after having carefully consider'd them, you are as fully satisfyed in the Conclusions that I have drawn thence: And that mine is the only Hypothesis that answers Nature, and solves all the Phænomena observable in the Earth, in an easy and Geometrical Manner. This, I say, keeps me in Countenance, and is a sufficient Support to me against other Gainsayers: And 'tis with no little Satisfaction that I take notice to you, that from what they print and declare, 'tis evident, that the Impartial all over *Europe* have the same Sentiments. It must be allowed a fair Presumption in Favour of the Truth of my Doctrines, that they have abid a very rigorous Test now for above thirty Years, stand yet firm; and the longer and more strictly they are look'd into, the more they are confirm'd to this very Day. Give me Leave to lay before you the Opinion of one that is still actually engag'd in these

Searches, very curious, a good Judge, and has carry'd them on over a great Part of the Globe, from *Numidia*, along the northern Parts of *Africa*, by the Ruins of old *Carthage*, quite on to *Egypt*, to *Arabia*, *Phœnicia*, *Syria* and *Paleſtine*; Countries from which we have hitherto had very few Accounts. This is Mr. *Thomas Shaw*, Fellow of *Queens College* in *Oxford*. The Words of his Letter to me, *June* 1. 1726, are, — *Wherever I have been, I have had ſuch convincing Proofs of what you advance in your natural Hiſtory of the Earth, that my Voyages are only imperfect Comments, and ſmaller Teſtimonies of what you have elſewhere much better obſerved.* I am ſure a Perſon of your Curioſity, will be pleas'd to know one Particular, which this ingenious Gentleman acquaints me with in another of his Letters. As he was making Obſervations upon the *great Pyramid*, he took notice of *Shells*, and other *Marine Bodies*, lodg'd in great Variety and Abundance, in the Maſs of the Stone, of which that Pyramid is built, and in that of the Rock wherein it ſtands, which

which is of the ſame Sort, and indeed in other Parts of the Country; which was obſerv'd of the Mountains of *Egypt* 2000 Years ago by *Ariſtotle*, and others of the Antients. Now this *Pyramid* is one of the firſt *Structures* that was rais'd after the *Deluge*. Indeed it was built within 250 Years of the Time of that great *Cataſtrophe*, when, you know, I have aſſerted thoſe Shells were brought forth of the Sea, and repoſited in the Strata of *Earth*, and of the Sand, that afterwards gradually hardned into Stone. Mr. *Shaw*'s Obſervation muſt be allow'd a conſiderable Confirmation of my Doctrine. The *Marine Bodies* in the Stone of the *Pyramid*, carry the Thing to near the Time I propoſe: And thoſe in the Strata of the Rock underneath, quite to it, and up to the very Time of the Compilation of thoſe Strata; which was during the Deluge [a]. The learned and ingenious *Steno* [b] made a like Obſervation in the vaſt Stones in the *Ruins* of the *Walls* of *Volaterre* in *Tuſcany*. In theſe he

[a] *N. H. E. Part* 2.

[b] De ſolido intra ſolidum. 4to Flor. 1669.

he found incorporated all Sorts of Sea Shells; which therefore muſt have been exiſtent before the Time that thoſe *Walls* were built, which was ſeveral Centuries before the Building of *Rome*; and that carries them back to within not many Years of the Time of the *univerſal Deluge*.

As you Sir! and Mr. *Shaw*, ſo ſome others of the greateſt Men in *Europe*, from the Time that my *Natural Hiſtory of the Earth* firſt came forth, have done me the Honour to aſſiſt me in the carrying on that Work, at their no ſmall Pains and Expenſe. Of theſe Dr. *Scheuchzer* Profeſſor of Mathematicks at *Zurich* is one. You are well acquainted with his Perſon, his Works, and his great Merits. Dr. *Leopold* of *Lubeck* is another; who finding my Collection not ſufficiently ſtored with *Swediſh Foſſils*, and that I had not a ſatisfactory Account of the *Mines* there, of his own Accord, and at his own Expenſe, undertook a Journey thither for my Satisfaction; with what Succeſs you may

ſee

ſee in a Letter that he was pleas'd to addreſs to me, *De Itinere ſuo Suecico*, in *octavo*, in the Year 1720. That celebrated Divine Dr. *a Melle*, of the ſame City, whoſe Writings in Divinity, Hiſtory, and Antiquity, have raiſed him into ſo high Eſteem in the whole learned World, was induced by the Peruſal of my *N. H. E.* to turn his Thoughts to the Study of *Foſſils*. The firſt Fruit of thoſe Studies was his *Epiſtola de Echinitis Wagricis*, 4°. *Lub.* 1718. which he did me the Honour to addreſs to me: As did likewiſe the ingenious and curious Mr. *Linckus* of *Lipſick* his *Epiſtola de ſceleto Crocodili in Lapide* 4to. *Lipſ.* 1718. The Count *de Schouberg*, Lord Chamberlain to King *Auguſtus*, and Superintendant of the Mines in *Saxony*, the richeſt and greateſt in all *Germany*, ſent me Samples of the Minerals and Ores there, with their proper Names, and thoſe by which they are known to the *Miners*; whereby I was enabled rightly to underſtand the Writings of *Kentman*, *Agricola*, and others the moſt learned, accurate, and experienc'd *Mineraliſts* of theſe

theſe laſt Ages. *England* and *France* being ingag'd in a War, when firſt my my Book came forth; and all amicable Communication betwixt the two Nations ſuſpended, 'twas not known there till the War was at an End. But, after that, it fell under the Cognizance of the Naturaliſts of *France*, from whom I have ſince receiv'd many Civilities: And in particular, from that great Mæcenas, *M. L. Abbe Bignon*, and ſome other learned Eccleſiaſticks, particularly of the Order of the *Jeſuits* there; from Dr. *Juſſieu* the King's Botanick Profeſſor, who oblig'd me with Samples of ſeveral *French* Foſſils, with very intelligent Accounts of them: But there being no conſiderable Mines in that Country, the Curious there have not had much Opportunity of carrying on theſe Studies. Monſieur *Valkeneir*, reſiding for ſome Years at *Zurich* in Quality of *Envoy* of the *States-General*, having peruſed the *N. H. E.* and approv'd the Deſign, promoted it with great Conſtancy and Diligence, not only over the Country where he reſided, but the greateſt Part of *Europe*;

rope; and my Collection has been much enrich'd out of his Store. But the greateſt and moſt beautiful Addition that ever was made to it, is owing to Signior *Agoſtino Scilla*, from *Rome*, he ſending me not only all thoſe noble *Foſſils*, that he collected in *Sicily*, and publiſh'd in his *Lettera circa i corpi marini, petrificati* printed at *Naples* in 4^to^, 1670, but likewiſe the *original Drawings* of each, done by his own maſterly Hand. I might mention to you ſeveral others; but theſe will be ſufficient to keep you in Countenance, and ſhew you that ſome, of the greateſt Character in the whole learned World, have not diſdain'd to embark in the ſame Bottom that you have done. As to thoſe who have honour'd me and my Undertaking with their Patronage here in *England*, 'twould be too great a Task to recount all; and therefore I muſt not mention any; which will be the leſs Loſs to you, as you are wholly a Stranger to them.

I am, *&c.*

NUMBER VI.

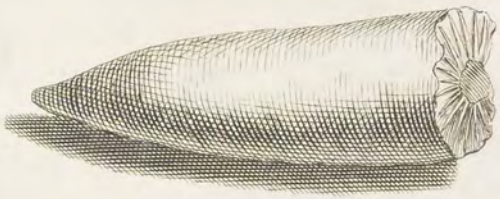
To the ſame.

Of the Origin, Nature, and Conſtitution of the Belemnites.

SIR,

AS to what you ſay of Mr. *Lhwyd*, he was much prejudic'd, and ready to catch at any Thing that might leſſen the Authority of what I have deliver'd. I rank the *Belemnites* amongſt the *native Foſſils*, he would fain have it be thought to belong to the *Extraneous*: and his Book coming into every Body's Hands, ſome fell into his Notion; particularly Mr. *Butners* [a], who examines little, and is very ready to fall in with any thing that comes in his Way. That is far from your Caſe; and tho' I have little Regard to them, I am ſo ambitious of

[a] *De Corall. Foſſil. c. 6.*



of the Opinion of a Man of your Weight, that I cannot contain my ſelf, from conſidering what you write of the Subject. I grant indeed, as you obſerve, that *my Hypotheſis is not at all concern'd of which Side ſoever the Queſtion is determin'd, and will not in the leaſt be affected, tho' the Belemnites be not, as I have aſſerted, a meer Stone.* But I am *concern'd* for the *Truth*, and have that Regard to you, that I would have you think I did not aſſert that, without ſufficient Grounds; nor has any thing hitherto been offer'd, that invalidates my Aſſertion. Whenever any Thing does, you will find me very eaſy and ready to give it up.

Mr. *Lhwyd* [b] at ſometimes fancies the *Belemnites* to be form'd in the *Pennecillæ Marinæ*, at others, in the Shells, call'd *Dentalia*. Thoſe are Bodies as different each from other as well can be, and both differ ſo much in Shape from the *Belemnites*, as to give little Umbrage

[b] *Lythophil. Britan. p.* 115. 121.

to the Notion that it could be form'd in either. Beſides, the Manner in which we commonly find the Belemnites, ſhews plainly it was not form'd in any Shell. When the Bodies ſo form'd are found lodg'd in the Strata of the Stone, tho' the Shells wherein they were originally form'd, be periſh'd and gone, the Stones, moulded in them, are conſtantly ſurrounded with a Cavity, or a Space wherein the Shell lay, which Cavity ever anſwers to the Shape, and is commenſurate to the Bulk of the Shell ſo periſh'd. Now the Belemnitæ are ever found contiguous to the Maſs of the Stone, without any ſuch Cavity ſurrounding them. In this we have Evidence of Senſe, and ocular Demonſtration, that the Belemnitæ were not form'd in a Shell, or any external Mould. Had they had any ſuch Mould, the Veſtigia of it would have been eaſily enough diſcern'd, and the Cavity where the Shell lay preſently diſcover'd. It muſt have been in ſome very large Shells. I have ſeen Belemnitæ near two Feet long, and above two Inches Diameter in the thickeſt Part. Shells in which ſuch

Bodies

Bodies could have been caſt, or the Cavities wherein they lay, would be ſo big, thick and long, as to be deſcry'd without Difficulty.

I am the more forward to think, that the Reaſons upon which you found your Suſpicions, are not very firm and clear, becauſe you are ſo unſteady in your Opinion. You formerly thought the Belemnites a Horn; now you fancy it a Tooth of ſome ſtrange Fiſh, Bodies quite different in all Reſpects from each other. Your firſt Arguments for its having been an Horn, is, that it is in *Form of a Horn*, whereas indeed there are different Species of the Belemnites: And they differ very much in *Form* from each other. The three principal Species are, the *Conoid Belemnites*, which is the moſt common. The *Belemnites fuſi-formis, J. Bauhini, de Fonte Bollenſi*, 4^to^, and the *Belemnites Cylindricus in apicem utrinq; deſinens.* If thoſe be all in *Form* of *Horns*, every Thing is in *Form* of a Horn. Your ſecond Argument is, That 'tis *lodg'd amongſt Shells, Teeth, and other*

other Animal Remains, found at Land, and in the Strata. In caſe this prove them Horns, it will prove Pyritæ, and many other mineral and metallic Bodies to be *Horns*, or *Animal Remains.* For theſe are found lodg'd amongſt Shells, Teeth, and other animal Remains, full as frequently as the *Belemnitæ* are. Your third Argument is, That the Belemnites has a *horny Smell.* Now, if this be admitted, 'twill bring almoſt half the native Foſſils into the Claſs of Horns, that *Smell* being common to *Stones*, and many other *Native Foſſils*, that have in them Sulphurous or Bituminous Principles; and theſe they exert in greater Plenty, if rubb'd and heated. Indeed Stone, when firſt taken out of the Earth, emits very different Smells, *Ol. Worm.* mentions [c] ſome that emitted a Smell like that of a Hog, which he therefore calls *Saxum Suillum*; other Stone, with the Smell of Violets, *Lapis Violaceo Odore.* They that are converſant with ſubterranean Things know, that not only Stones of various,

[c] *Muſeum Worm.*

various, but even of the very ſame Sort, emit very different Smells; ſo that no certain Judgment can be form'd from the Smell. Beſides, I muſt acquaint you, that the Belemnitæ of *England* have rarely any Smell at all. They are found in great Numbers in Chalk, and I never could perceive a Smell in any of theſe. Thoſe that you found attended with that Smell, had lain amongſt Saline, Sulphurous or Bituminous Matter, that had imparted it to them. But what ſeems to me finally to determine this Controverſy, and evince that the *Belemnites* is not a *Horn*, is, that *Horns* are very ſeldom found in the Earth. I have aſſign'd a plain Reaſon for that in the *Diſſertation preliminary to my Natural Hiſtory of the Earth*, I have ſhewn there, that *Horns*, *Hoofs*, *Teeth*, *Bones*, and other like *Animal Subſtances*, being lighter than the common Sea-Shells ſubſided laſt, and conſequently being *lodg'd near the Surface* of the *Earth*, and there expoſed to the Weather, and external Injuries, are generally periſhed and deſtroyed; few of them remaining at this Day. Whereas the Belemnitæ

lemnitæ are frequent, obvious, and occur almoſt every where. Nay, they are found to very *conſiderable Depths* in the *Earth*, which is owing to their ſpecifick *Gravity*, much greater than that of *Horns* or *Teeth*, but equal to that of *Talky Bodies*, in which Claſs I have rang'd them. *That* their *greater ſpecifick Gravity* furniſhes us with another Proof, that they are not *Horns*, or *Teeth*. A further Argument of which is, That they differ greatly in *Texture*, *Conſtitution and Subſtance* from *Horns*, *Teeth*, or any other like Parts of Animals. But they agree very nearly with ſeveral Minerals. I have ſeen ſome that are Semi-diaphanous, yellowiſh, and ſomewhat reſembling common Amber; which the Antients obſerving gave to both *Amber*, and the *Belemnites*, the ſame Name, *Lapis Lyncurius*; this Name importing that both were of an Hue yellowiſh, and like that of Amber; as are likewiſe ſeveral *Talcs*, *Spars*, and other Products of the Mineral Kingdom. Then, as to the *Conſtitution* of the *Belemnites*, if it be broke in any Manner, it is not tenacious and tough, as all Ani-

mal Subſtances are: but *friable* and *brittle*, like *Talky* and ſuch other Foſſils. The Subſtance of it appears to be mineral even to the View; and this is confirm'd both by the Operation of chymical Menſtrua, and every other Teſt. Its Texture is directly contrary to that of Teeth, and other hard Animal Subſtances, ſtriated acroſs; the Fibres diametrically interſecting the Axis of the Body; whereas the main Fibres of Teeth, Bones, Horns, Hoofs, Claws, Nails, and all hard Animal Subſtances run the quite contrary Way, and parallel to their Axis. But the ſtriated or *fibrous Talc*, the *Gypſum Striatum, talky plated Spars*, the *Aſbeſtos, Alumen plumoſum*, the *ſepta* of the *Ludus Helmontii*, the *Pipes* of the *Lapis Syringoides*, the Cruſts of the *Hæmatites*, and ſeveral other Talky Minerals, that might be recited, have their Fibres running in a tranſverſe Manner, like thoſe of the *Belemnites*. A remarkable Inſtance of this Texture we have likewiſe in ſome *Stalactitæ*, conſiſting of a *Talky Spar*, and found hanging down from the Tops of Grottos under Ground. There

are, in my Collection, ſeveral that are ſtriated acroſs.

THESE Things rightly conſider'd, I hope I ſhall not be accus'd of Lightneſs, or Precipitation, in judging the *Belemnites* allyed to the Foſſils of *Talky Conſtitution*, as I have done. It has nearly the ſame *ſpecifick Gravity* that the *Talky Bodies* have, and is much heavier than Horns or *Teeth*. Then 'tis exactly of the ſame *Nature, Texture, and Conſtitution* that they are, and different in all thoſe Reſpects from Horns, Bones, or *Teeth*. Nay, I am perſuaded, the Arguments that I have offer'd, taken from the Shape of the *Belemnitæ*, are ſufficient to ſatisfy any reaſonable Man, and indeed amount to near a Demonſtration, that they cannot have anſwer'd the Ends, nor ſerv'd for the Uſes of *Teeth*, either to ſeize the Prey, or to chew it.

BUT, tho' it be certain, that the Belemnitæ have now none of them, any Thing of *Animal Subſtance* remaining, I allow it does not thence neceſſarily follow,

low, that they may not have been of Animal Origin; but 'tis very ſtrange, they ſhould *all of them* be thus chang'd; of which we have no Inſtance in any other Body whatſoever. 'Tis indeed not uncommon to find Shells of various Kinds quite chang'd, the Teſtaceous Subſtance diſſolv'd, and a Mineral Subſtance ſubſtituted and repoſited in the Room and Place of it. Nay, there are digg'd up, Parts of Trees ſo chang'd; and I have ſhewn [d] how theſe Changes were brought about. But then, the Inſtances of theſe are are very few in Compariſon of the whole: And for one Shell that is thus chang'd, there are found hundreds that are not chang'd at all. Whereas the Belemnitæ are all changed, if any of them are.

WHAT I here offer, I intend as a Prelude and Introduction to what I am about to deliver in Anſwer to the Argument urged from the *Tubuli Vermiculares*, and ſmall *Oyſter-Shells* that are ſometimes

[d] *Anſwer to Camerar. Part* 1. §. 6.

times found adhering *externally* to the *Belemnites*. For, from this *Phænomenon*, ſome have haſtily infer'd they are of marine Origin, and that theſe Shells were affix'd to them in the Sea before the Deluge. That will not by any Means follow from this; ſince there are *Flints*, *Pyritæ*, and other *native Foſſils*, that were never exiſting in thoſe Seas, that yet have Sea Shells adhering to the *Outſides* of them: And ſuch I have in my Collection. For theſe, being ſtony and Mineral Nodules, among which I have ranked the Belemnites, were form'd during the Time that the Water was out upon the Earth [e]: And the Matter which conſtitutes them, then concreted, and affix'd to theſe Shells.

But there may be a Teſt ſettled, whereby this Affair may be fully determin'd, and it may be aſcertain'd, whether the Shell upon it, or the Belemnites, was form'd firſt. The Shells that affix themſelves unto, and grow upon Rocks, Stumps

[e] *Nat. Hiſt. Earth, Part* iv.

Stumps of Shrubs, and other fix'd Bodies, upon the Sea Shores, conform themſelves in their Growth, ſo exactly to the Surface of the Body on which they grow, as to take the Form of it. Now, if thoſe on the Surface of the *Belemnites* have done the ſame, and exhibit conſtantly the Lineaments of its Surface, then they were form'd ſince the Belemnites. But if this, in thoſe Parts where it is contiguous to the Shell, be not, as it uſually, and naturally is, ſmooth and plain, but exhibits the Lineaments, or any Impreſſion of the Shell, then 'tis certain the Belemnites muſt have been form'd ſince the Shell: And much more, if there be Shells found included in the Subſtance, or incorporated with the Maſs of the Belemnites. As, in all my Studies and Searches, I have nothing but the Truth in View, I willingly ſubmit to this Teſt, for the Deciſion of this Affair, and to further Inquiry. For I have ſo ſeldom found *Belemnitæ* with *Shells* upon them, that I have not Obſervations enow of my own to determin it. There is but one in my Collection, that hath a few very ſmall Shells

Shells upon it; and I am unwilling to break it to make the Experiment.

THAT you may ſee I have not been without Thoughts of this Subject, near twenty Years ago, when I was drawing up my *Catalogue of the Foſſils of England*, taking notice of theſe Shells affix'd to the Belemnites, I enter'd there a Suſpicion grounded on this; with a Note for further Inquiry, *Whether the Belemnitæ may not have been originally Horns, or other like Animal Appendages; of of which we ſee, by the Aſteriæ, Eutrochi, and many more, there are, or have been, vaſt Numbers at the Bottom of the main Ocean, that never appear upon the Shores.* Nay, Sir! I will fling you in of Courteſy, another Note that I made at the ſame Time, *(Viz.)* "The Belem-
"nitæ ſometimes appear to have been
"compreſs'd, crack'd, and deſtroy'd;
"which is what I do not remember ever
"once to have obſerv'd in any Foſſil that
"was not form'd in an Animal Mould.
"But, in theſe, in Flints form'd in
"*Echini*, and ſome others, there are ſuch

"In-

" Inſtances; " of which there are Accounts in the *ſecond Part* of that *Catalogue.*

I am ſo ambitious and deſirous, Sir! that you ſhould have full Satisfaction, that I will proceed a little more particularly to examin the Notion, that the Belemnitæ have ſerv'd as *Teeth.* Now, of the many Hundreds that I have ſeen of theſe Bodies digg'd up here, and brought from Abroad, I never ſaw one that had the leaſt Appearance of a *Fang* or *Root*, whereby it might be fix'd and detain'd in a *Jaw.* Whereas the *Teeth* of all Creatures that I have obſerv'd, as well thoſe that are the Product of the Water, as of the Land, have all *Roots*, or ſome Signs of their having been connected to a Jaw. I know it will be ſaid of the *Belemnitæ*, that the Roots are broke off, and loſt. But 'tis ſtrange, of ſo great Numbers as we find, there ſhould not be the leaſt Sign, or Remain of a *Root* on any. The Caſe is different in all other *Teeth*, as of *Sharks*, and other *Fiſhes*, and indeed all other Creatures digg'd up out of the Earth;

Earth; these being commonly found with the *Roots* on, or, at least, with some *Remains* and *Signs* of *Roots*.

THEN, there is *one Kind* of *Belemnites* that is of such *Shape*, that I think it could not have serv'd for a *Tooth*, or even possibly have been fix'd in a Jaw; I mean the *Belemnites fusi-formis* of *J. Bauhini*[f]. This terminates in an *Apex*, or *Point*, at *one End*; which, if any, must have been the Tip, or upper Extremity of the *Tooth*. But the Part of the Body, next this, is turn'd crass and thick; and the other for at least half the Length of the Body, very slender and thin. Now, tho' this was the Root, of which yet there is not the least Appearance, it being of the very same Constitution with the rest of the Body, which the Roots of the Teeth of these Fishes that I have seen, never are: Or tho' there was, at the Extremity of this, a Root annex'd, and since broke off, the contrary of which may be demonstrated meerly from View of

[f] *De Fonte Bollensi. Pag.*

of ſeveral in my Collection, they being at this End ſo very ſmall, that there was not Scope for Hold ſufficient to connect or fix it to any Thing. I ſay, which Way ſoever it be ſuppos'd, intire, or broken, that Moiety of this Body, which muſt be imagin'd, if any, to have been next the Jaw, is ſo ſlender and ſmall, that it is demonſtrable it could be of no Uſe, and that the leaſt Force would break it; eſpecially if it be conſider'd of how tender and brittle a Nature it is. Whereas the other Moiety of this Body is ſo tumid, thick and groſs, that it could never be got to enter the Prey for taking of it, which theſe, if Teeth, muſt have ſerv'd for, without a very great Force, and ſuch, as the other Moiety could never have Strength near ſufficient to ſuſtain, without being ſurely broke in the very firſt attempt. So that 'tis evident this Body could never have ſerv'd as a Tooth.

The third Sort of *Belemnites* is very nearly of a *Cylindrick Form*, only terminating at each End in a *Point* or *Apex*,

very ſhort, ſo as rarely to exceed $\frac{1}{10}$ of an Inch of Length. This is of the ſame Nature, Texture, and Conſtitution with the two precedent Kinds: And this I have found frequently *intire*; but I have never found any of the *Conic* that was ſo, tho', as has been intimated, they occur frequently, and in great Numbers; which I can hardly ſay of any Sort of Foſſil beſides, either native or Extraneous. For which Reaſon ſome have ſuſpected that the common or Conic Belemnites is broke in two about the Middle; and that it terminated originally, and while intire, like that above ſpecified, in a Point, at both Ends. Be that as it will, the Species that I am now treating of, has not the leaſt Appearance of its having had any Connexion with a Jaw. Nor indeed is a Body of ſuch a Shape, by any Means capable, either of being fix'd in a Jaw, or of taking of Prey, or of chewing of it. Indeed the *common Belemnites* is not much more capable of anſwering either of thoſe Uſes. It is generally ſo blunt at the End, as not to be capable eaſily to enter the Prey; and yet not

not blunt or flat enough to maſticate and chew it. Beſides, both this, and the other two Kinds, are ever *ſtreight*; whereas the *Dentes Apprehenſores*, of all the *Fiſh of Prey* that I have ever ſeen, are, the better to fit them for taking the Prey, in ſome degree crooked. I wiſh my Deference to your Judgment, and the Zeal I have to give you full Satisfaction, have not drawn me on ſo far, as, inſtead of that, by this Time to have given you Pain, and tired out your Patience. *That* I muſt leave to your Goodneſs; but, for fear of the worſt, I will defer my Returns to what you are pleas'd to command in Relation to the *Coralloids*, or *Coralls digg'd up at Land*, to ſome other Opportunity.

I am,

always with great Regard,

Sir, *&c.*

NUMBER VII.

Of the Coralloids digg'd up at Land; the Nature and Origin of them.

SIR,

WHILE there are ſo many forward to write, and think themſelves qualify'd for that Purpoſe, ſo ſoon almoſt as they turn their Thoughts to any Subject, and without, firſt, being at the Trouble of duly appriſing themſelves of it, or of what others have deliver'd concerning it, the Minds of their Readers muſt be in a perpetual Maze, and Truth upon a lubricous and very unſteady Foundation. The more ſo, as there are ſome, who, tho' really much better Judges than the Authors they read, without Suſpicion, or due Examination, fall into their Sentiments, and adopt their Notions. 'Twas this Way, Sir! that I am perſuaded you fell into yours, of the Origin of the Coralloids, as one or two other very excel-

excellent Men have done, I mean, on Peruſal of Dr. *Buttners Corallographia Subterranea*. That Author follows me, tho' he be not pleas'd to refer to my Book, in moſt other Things; and thinks, ſo far as he is wont, he does ſo even in this; ſailing on in a full Gale of Fancy, and judging of Things pell-mell, he ſtumbles, thro' meer Inadvertency, into the Notion, that the *Foſſil Coralloids* are of *Antediluvian Origin*; and were by the Deluge brought out of the *Sea*, along with the Shells, and other *Animal Subſtances*, to Land. Indeed, that he may proceed in Form, and the more like an Author, he brings in what he is pleas'd to call *Arguments*, in Support of this. But, being on no very high Guard, unluckily they either prove nothing at all; or elſe the quite contrary of what he alledges them for: His firſt method of arguing is from *Similitude*; and comparing the *Foſſil Coralls* with the *Marine*. He avers both have what he calls a *Baſis* or *Root*. That is commonly true of the *Marine*; but of the *Foſſil Coralls*, he gives not ſo much as one ſingle Example that is clear and plain;

plain; nor of the Multitudes that I have ſeen, have I ever met with one. His ſecond Argument is, that *both* have been *once* ſoft, or in a State of *Solution*. That I have prov'd very fully; but it makes nothing for his Purpoſe; the Queſtion is not about the *Fact*, but the *Time*. No Body doubts, but that they were *ſoft* at the *Time* of their *Formation*; all Things in Nature whatever, are ſo; but that *Time* was not, as he preſumes, *before*, but *during* the *Deluge*. He proceeds in his Way of comparing the *Marine* with the *Foſſil Coralls*. Some of thoſe, he ſays, have a Tendency to a *Vegetable Form*, they have *Trunks, Knots, Branches*; ſo likewiſe have theſe: Others of them have *Pores, Stars*, and other Accidents, wherein they agree with theſe. But then he knocks down all again, and comes over to me, when he avers, that the *Coralls found at Land*, are of a real *ſtony Nature*, and *chiefly of Flint*. If this be ſo, they are as different as well can be from thoſe *found at Sea*. He never ſaw one of thoſe of *Flint*. However that be, he is peremptory as to the

Foſſil

Foſſil Coralls: And goes on to aſſert, That *Flint is nothing elſe but an Antediluvian Corall.* Cap. vi. §. 2. Now *Flint*, or *Chert* is found in Form of *Strata*, as well as in *Nodules* of all Forms, of which ſome few are jagg'd and uneven, which are what I ſuppoſe he calls *branch'd.* So that if Flints are Coralls brought out of the Sea, Free-Stone, Marble, and, to be ſhort, every Thing elſe that is either in Form of *Strata*, or *branch'd*, muſt, by this Way of Reaſoning, be brought thence too. His next Argument is, That the *Foſſil Coralls* are found lodg'd in the *Strata* along with *Shells*, and other *Productions of the Sea.* The Fact indeed is ſo; and it has been obſerv'd a thouſand Times, that there is in the Strata ſuch a Confuſion of Things of the moſt different Nature, and Origin, Animal, Vegetable and Mineral; but whoever made an Inference like this from it before? There are found lodg'd in the Strata with *Shells*, *Nodules* of all Kinds, *Stony*, *Mineral*, *Metallic*; does it follow that theſe were brought from Sea, becauſe the Shells were? If it do, all Bodies whatever

ever were brought out of the Sea. Dr. *Buttners* rejects *Chymical Trials* of the Coralloids, Cap. 6. §. 17. except in one Case, which makes for his Purpose, where he alledges in Proof, that *Flints* are *Coralls*, because *they* will *calcine* as well as *these*. Cap. vi. §. 8. which, that I may note that by the by, brings Stones, and all other Bodies that may be *calcin'd*, into the Class of *Coralls*. In fine, his only grand, and, as he thinks, *infallible Argument*, is founded wholely on their exterior *Form*, and *Structure*, *tantùm ex structurâ Coralliorum marinorum, tanquam notis characteristicis certissimis nostra judicemus Fossilia.* Cap. v. §. xvii. He neither cares to admit *Chymical Trials*, nor bring both to the Test of their *specific Gravity*, nor indeed any other, whereby Judgment may be form'd, of their *interior Constitution*, *Substance*, and the *Matter* of which each are compos'd; tho' that be the only sure Way to shew the *true Nature* and *Origin* of both. To that therefore I shall have Recourse: Of the Multitudes that I have observ'd, I never light of so much as one single

Fossil

Foſſil Coralloid that agreed with the Marine, or was of the ſame *Subſtance* and *Conſtitution*. How greatly they differ from the Marine, and indeed from each other in *Subſtance*, may appear from the following Inſtances. Many of them conſiſts wholly of a *Sparry* Matter. Others of *Cryſtall*, ſometimes very near clear and pellucid. Some of them have their conſtituent Matter of Flint, others of Agat. Others of Vitriolic, and the like Salts, that ordinarily in Tract of Time moulder, liquate, and fall to Pieces, after the Manner of the Vitriolic, and other Salts in the common Pyritæ. I have ſeen *Foſſil Coralloids* that have been compos'd of various Sorts of Mineral and Metallic Matter, that yet have been form'd into Shape of the *Marine Mycetitæ*, *Aſtroitæ*, and other like *Coralls*. Now all theſe have been form'd out of the diſſolv'd Mineral, and Metallic Matter in the Water of the Deluge [a]. The Antediluvian Coralls were like all other ſolid ſtony Bodies then in Solution in that Water;

[a] *Nat Hiſt. Earth. Part.* iv.

and might concrete again, and form true Coralls, there, as well as in the Sea-Water. Doubtleſs it did ſo; but that Matter was in ſo ſmall a Quantity, and bore ſo little a Proportion to the Mineral and Metallic, with which it was then mix'd and confus'd, as now rarely, if ever, to be met with. I never found one Sample compos'd of it, pure and diſtinct. Which cannot be thought ſtrange, if the Antediluvian Coralls were all diſſolv'd and deſtroy'd. Whereas, if they had been preſerv'd, and, as Dr. *Buttners* ſuppoſes, brought, along with the Shells, to Land, they muſt have been now found commonly there, as well as the Shells. They would be full as eaſy, or indeed more eaſy to be diſcover'd, than the Shells; not only as they muſt have been in great *Numbers*, but very many of them are of *Colours* that ſooneſt ſtrike the Eye, and are the moſt eaſily diſcern'd. Such are the *Fiſtularia purpurea* of *Ferrante Imperato*, and the *Red-Corall*; of both which there are ſuch vaſt Quantities found in ſeveral *Seas*, particularly in the *Mediterranean*, on the Coaſts of *Spain*,

Spain, Italy, and *Sicily.* Then, many Kinds of the *Marine Coralls* are very *large*, ſo that, had they been brought forth, and left at Land, they muſt have been obvious, and very eaſily found out. I need go no further for proof of this, than to the *Aſtroites Maritimus Coralloides undulatus major,* or, as 'tis commonly call'd, the *Brain-Stone.* This is found in great Numbers, in *ſeveral Seas:* And I have ſeen of all Sizes, to twice, nay, thrice the *Bigneſs* of an *Ox's Head.* Surely ſuch Bodies as theſe, were there any, could not be hard to ſpy out.

Upon the whole, I think 'tis very evident, that there are few, if any, *true Sea Coralls*, ever *found at Land.* Conſequently thoſe that we do actually find were not brought from Sea: And Dr. *Buttners* is led into his Error, by taking a meer *Cloud for Juno*, Bodies that had only ſome ſlight *exterior Reſemblance* of Coralls, but nothing of their *Subſtance* or *Conſtitution*, for real Coralls. When the *Spaniards* firſt took

Poſſeſſion of *Mexico*, amongſt other Things new and ſurprizing, they found in the Gardens of the *Americans*, plac'd for Ornament, in a very elegant and beautiful Manner, *Artificial Flowers*, which they had made of *Gold*, ſo nearly approaching, in exterior Form and Shape, the true, as to cauſe much Admiration in the *Spaniards*; as near indeed, or perhaps nearer than the Foſſil Coralloids do the Marine Coralls. But yet I have not heard, that any of the *Spaniſh Philoſophers* fell into the Speculation that theſe fine *Gold Flowers* were brought forth of *Seeds*, as the natural were. Tho' had theſe Gentlemen done ſo, they had full as much, and indeed the very ſame Reaſon of their Side, that Dr. *Buttners* had; and he might juſtly have claim'd the Honour of being added to this *Hiſpano-American Sect.* As things now ſtand, I'm as much puzzled to find out, in what *Sect* of *Philoſophers* to *range* a Gentleman ſo anomalous as he is, in what Claſs of Foſſils to range the Belemnites.

I wiſh,

I wiſh, Sir! that I have not, by this Time over-convinc'd you, and brought you to your *Ohe! jam ſatis eſt, Ohe!* Tho' it be ſo, that I have, I ought to make no Apology: You have put me upon a Sort of Force. If the *Belemnites* ſhould, tho' I ſee no likelihood of that, prove not to be a native Foſſil, no more is needful than to change its Rank. You own your ſelf it affects not the Whole. But, as to the *Coralls*, in caſe thoſe *now digg'd up* be the *Antediluvian*, they are a laſting and ſtanding Monument and Evidence, that there interven'd no *Diſſolution*; or, at leaſt, that it was not *univerſal.* For, if one Set of Bodies, really ſtony, could ſo maintain their *Solidity*, and ſecure themſelves againſt the common Law then in Force, ſo as to continue intire and *undiſſolv'd*, why might not any, or all the other Setts do ſo too? You muſt not therefore blame me. You ſee the Queſtion is of the utmoſt importance: And you have made it neceſſary for me to give you all this Trouble to defend it, and ſhew you, that

that theſe *now digg'd up*, are *not real Coralls*, but of very *different Nature*; which I hope I have done to your Satisfaction, and ſhall rejoice to hear that.

I am, Sir, *&c.*

NUMBER VIII.

Concerning Coralls, Corallin, and other like Bodies form'd at Sea.

PREFACE.

THO' theſe elegant, beautiful, and very extraordinary Bodies, have been much admired in all Ages; yet, lying far out of the Way, being hard to come at, and their Growth under Water, where accurate Obſervations cannot well and eaſily be made, 'twill not be thought ſtrange, that our Accounts of them are mighty defective, and that little Progreſs has been hitherto made in the Natural Hiſtory, and the Proceſs us'd in the Pro-

Production of them. 'Twas this which first drew my Thoughts to the Study and Consideration of them. But when afterwards I found at Land, and in the Bowels of the Earth, *various Bodies carrying some* exterior Resemblance *of the* Marine, *it ingag'd me to allow them some further Consideration, and carefully to compare both together. In order to this, the Coasts of* England *yielding very few Coralls, I had Recourse to my Friends in Foreign Parts, where these Bodies are found in greater Plenty and Variety; and by their generous Contributions, my Collection has been so far increas'd, as to exhibit Phænomena sufficient to point forth the* Process of Nature *in the* Formation *of these* Bodies. *Of this I have prefix'd some Account to the* Catalogue *of the* Coralloids *digg'd up in* England. *The following* Directions *were drawn up at the Request of Sir* Hen. Newton, *then* Envoy *of* Great Britain *in* Tuscany, *on the Coasts of which Country these Bodies are more frequent.*

DIRE-

DIRECTIONS

For making Obſervations on Coralls, Corallin, and other like Bodies.

I. GET an Account of the ſeveral Places in which Corall is found.

II. ALSO of the various Kinds of Corall found in each Place: Their various Shapes and Colours.

III. AND of the Manner and Poſture in which the Corallin Bodies, particularly the Shrubs, grow; whether erect, horizontal, or hanging down like Iceicles from Jetts of Rocks.

IV. AT what Depth the Corall grows. And whether only in Parts of the Sea

that are under Shelter, and quiet, as in Creeks and Bays; or in thoſe that are more expoſed and diſturbed, as off Promontories, and the like: Or in both indifferently.

V. Of the Colour, Nature, and Conſtitution of the Rocks and Cliffs, upon, or near which the Corall grows. Particularly obſerve, whether there be any Red Stone, or other terreſtrial Matter that is Red, near thoſe Parts where the Red Corall grows.

VI. What is the Senſe and Opinion of the *Peſcadori*, or Corall-Fiſhers, and of other more intelligent and curious Obſervers of the Growth and Formation of Corall; of the Matter whereof it is formed: And of the Place from which that Matter is deriv'd.

VII. To what other Bodies is Corall found growing beſides Rocks, looſe Stones, Pebles, Flints, and Shells.

VIII. Is there any Way of making Judgment, whether the Corallin Bodies grow quickly or ſlowly: And in what Space of Time they are formed.

IX. Are the Corallin Bodies ever found broken and beat off the Rocks by the Agitation and Motion of the Sea in Storms.

X. What are thoſe Creatures that the Corall-Fiſhers call Worms, that ſcoop, bore, and hollow the Coralls.

DIRECTIONS *for making Collections of Corall, Corallin, and other like Bodies.*

I. SEND Samples of Corallin Bodies of all Sorts, all Sizes, Shapes and Colours.

II. Also

II. ALSO of thoſe which are various; ſeveral Sorts, or Corallin Bodies of ſeveral Colours, growing together.

III. AND Samples ſhewing the Manner of the Growth of the Corallin Bodies, upon Stones, Shells, or any other Things.

IV. LIKEWISE of all Bodies whatever, that are drawn up by the Corall Fiſhers; not only the Corallin Shrubs, Red, White and Black; but of the *Corallo Stellato, Articolato, Hippuris Saxea Pori, Millepora, Retepora, Frondepora, Madrepora, Tubularia,* [mention'd by *Ferrante Imperato, Hiſtoria Naturale.* L. 27.] *Fungi Marini,* [mention'd by *Padre Boccone* in his *Obſervation. Nat.* 12°. his *Muſeo di Fiſica,* 4°. and his *Recherches and Obſerv. Naturalles* 8°.] *Brain-Stones, Aſtroitæ,* and all others: And even of the Corallins, Sea Fans, Halcyoniums, Sponges, Moſſes, Algas, or Fucus's, Sea Shrubs, and Sea Weeds, of all Kinds: As alſo of the Shells, and

Stones of all Sorts. In a Word, Samples of all Bodies whatever, that are dragg'd up in the Corall Fiſhings: And particularly of all thoſe Bodies that the *Peſcadori* call *Ravano.*

V. SEND Samples of the Rocks in the Neighbourhood of the Corall-Fiſhings; and of any other terreſtrial Matter, out of which the Corall may be imagined to be formed.

THE PREFACE.

THOSE who travel and pass suddenly from Place to Place, have less Opportunity of informing themselves of all Circumstances of Things, than they that dwell, and are constantly upon the Spot. For which Reason, wherever I found, that either the Proprietor himself, some other Gentleman that happen'd to live near, or the Steward and Overseer of the Mines, had Curiosity and good Disposition, I engag'd them to make Observations and Collections; leaving with them Directions *for the Purpose. By this Means I receiv'd some Additions; but not to near the Number that, were Gentlemen better apprized of the Uses of these Things than they commonly are, I might have reasonably expected.*

Partly therefore on this Account, and partly becauſe my Affairs call'd me up to London, *before I had compleated what I firſt deſign'd, and viſited all the Mines that I intended, I concluded to ſend Perſons on Purpoſe to all Parts where I wanted further Satisfaction and Intelligence; which I did at my own private Expenſe.*

Of theſe, the firſt that I imployed thus was Mr. Thomas Lower, *my Servant, a young Man, related to Dr.* Lower, *and of a good Family in* Cornwall. *Thither I diſpatch'd him with* Directions *to make Obſervations in the Tin Mines, and to collect all the Ores and other Minerals he could procure. Being a ſenſible Man, and very careful, he executed his Commiſſion with that Succeſs, that he not only made for me a large* Collection *of Samples, well choſen, but a great Number of pertinent* Obſervations *of the Water in the Mines, and the Condition of Things there very much to my Purpoſe.*

This encourag'd me to proceed, and ſend others on the ſame Deſign; which I did,

did, but none to better Purpose than Mr. John Groom, *and Mr.* Richard Meales, *two learned and ingenious Gentlemen, who were pleas'd to travel over a great Part of* England *for me, and particularly all the northern Countries.*

'Twas for the Service and Conduct of these Gentlemen, that the following Directions and Queries were drawn up. Those relating to the Oeconomy of the great Abyss, Steams and Damps in Mines, Fogs and Mists on great Mountains, and to Meteors, were added by Command of the Lord Bishop of Man, *and Sir* George Wheler, *two Persons not more illustrious for their Piety, Virtue, and Knowledge in their own Profession, Theology, than their Insight into all other good and useful Learning. Residing in Parts where they had great Opportunities of making these Observations, they were the more capable of promoting my Design; and indeed I am oblig'd in Gratitude to acknowledge they were two of the most generous Benefactors to it.*

BRIEF DIRECTIONS

For making

Obſervations and Collections,

AND

For compoſing a travelling Regiſter of all Sorts of FOSSILS.

I. *Of keeping a Regiſter of the Foſſils as they are Collected.*

BY Means of Paſte, Starch, or ſome fit Gum ought to be fix'd on each Sample collected, a bit of Paper, with a *Number upon* it, beginning with N°. 1. and proceeding to 2, 3, and ſo on, in a continual arithmetical Series. Then, in the Regiſter, enter *Numbers*, anſwering thoſe fix'd on the

Foſſils, and under each Note, 1°. *what Sort* of Foſſil or Mineral 'tis reputed to be. 2. Where 'twas found. 3. Whether there were more of the ſame, and in what *Number* or *Quantity*. 4. Whether it was found on the *Surface* of the Earth: 5. Or, if it lay deeper, note at what *Depth*. 6. In what *Poſture* or *Manner* it lay. 7. *Amongſt what* Sort of terreſtrial Matter 'twas lodged: 8. Whether in a Stratum, or perpendicular Fiſſure.

II. *Of Searches upon the Surface of the Earth.*

WHERE the Ground is covered with a *Turf* and *Herbage*, few Minerals are to be met with ordinarily, unleſs in ſuch places as have been formerly ploughed. But where the Earth is diſturbed and turned up by *plowing*, *digging*, or any other Means, there Minerals are frequently brought forth, and expoſed to Light; ſo that *ploughed Fields* ought not to be neglected; eſpecially thoſe that lye *high*, and are *raiſed* above the neighbouring Plains and Valleys; for in ſuch the looſe Mould

is

is waſh'd off by Rains, born down, and by that Means ſuch obſervable Foſſils of all Kinds, as lay within, near the Surface, are laid bare and uncovered.

BUT the Tops and Sides of *Hills* and *Rocks*, the Earth and Sand being perpetually worn and beaten down by Showers and Storms, never fail of a *more plentiful Shew* of theſe Bodies, and a fuller Gratification of the Curioſity of an Enquirer.

THEN, for the *Shores* of *Rivers*, and of the *Sea*, and the *Cliffs* adjacent, theſe uſually afford Variety of Minerals, and other obſervable Bodies; the Water waſhing and bearing off the Earth in which they were originally lodged, by that Means expoſing them to View. 'Tis here we find great Numbers of Pyritæ, and other Mineral Nodules: Nay, oftentimes Jett, Amber, Agates, and Stones of much greater Worth: As alſo Shells, Teeth, and other like Things that came firſt forth of the Cliffs and neighbouring Earth

Earth in which they had lain ever ſince the Deluge.

But the Bowels, and *deeper Parts* of the Earth, contain the greateſt Number and Variety of theſe Bodies. And, for Diſcovery of them, Recourſe muſt be had to ſuch Places where there is ſinking for *Metalls, Marble, Stone, Alabaſter, Coal, Gravel, Chalk, Oker, Fullers-Earth, Clay* for Pots, Tyles or Bricks, *Sand, Marle,* or the like: Or when there are Wells making: And in ſhort, wherever there is *Digging* upon any Occaſion whatever.

III. *The Method of making* Obſervations *in* Mines, Pits, *and* Quarries, *and of compiling a* Regiſter *of them.*

I. The firſt Thing to be taken notice of is the Place and Site of the Mine, Pit, or Quarry, whether it be in a *Valley*, on a *Plain*, or on an *Hill.*

II. Whether the *Deſcent* into it be perpendicular, and by a downright *Shaff*, or

or the Paſſage down be only upon a ſhelving or inclining Way.

III. Note the *Extent* of the *Aperture* of the Quarry Pit or Mine; as alſo of the ſeveral *Vaults* in it, and how far the Strata or Beds of Stone, Earth, *&c.* are *extended* and expoſed to View in Front.

IV. Then proceed to conſider the ſeveral Strata, remarking, 1°. how they *terminate*, or whether they be diſtinguiſhed from each other only by the *different Nature*, Colour and Conſiſtence of the Matter that conſtitutes them; or are ſevered by Joints, Partings, or *Fiſſures* running betwixt them. 2°. In what *Poſture* the Strata lye, whether level and horizontal, or *inclining*. If the later, note to what Point of the Compaſs the Dipping or *Inclination* bears, and how many Inches or Feet the Stratum ſinks below the Level, or horizontal Plane, in ſome certain determinate Space; as ſuppoſe in the Courſe of 4, 6, or 8 Yards. 3°. Whether all the *Strata* lye *parallel*, and conformable to *each other*, and to the exterior *Surface* of

the *Earth.* 4°. After this, come to a closer Examination of each single Stratum apart, beginning at the *Top*, and taking them one by one in Order as they lye, quite down to the *Bottom* of all; noting every Particular observable Circumstance in each; e. gr. the *Thickness* of the Stratum, and whether it be of equal Thickness in all Parts of it. The Thickness of the several Strata, added together at last, give the *whole Depth* of the Mine, Pit, or Quarry. Or if these cannot conveniently be measured singly, the whole Depth may be taken; the *Consistence* and Constitution of the Matter or Bodies that compose the Stratum, 1. Whether it be loose and soft, or hard and solid; or partly loose and partly solid; what particular *Sorts of Matter* each Stratum is composed of, e. gr. Marble, Alabaster, Free-Stone, Lime-Stone, or any other Sort of Stone; or Coal, Ochre, Chalk, Sand, Gravel, Clay, Marle, or of Metallick or Mineral Matter: What other *Sorts of Fossils* are embodyed in, or lodged amongst the ordinary Matter of the Stratum; e. gr. *Stones of an observable Figure,* as the Belemnites, Selenites, Myce-

Mycetites, Corallites, Aſtroites, *&c.* or any *Mineral Nodules*, ſuch as the Pyrites, Marcaſite, Hæmatites, Manganeſe, Jett, Amber, Agate, Cornelian, Flints, Pebles; or *Metallick Nodules*, or Lumps, yielding Copper, Iron, Tin, Lead; or any *Metallick or Mineral Matter* interſperſed in *ſmall Parts*, and mixed with the Sand, Stone, Earth, or other common Matter of the Stratum; examining whether the ſaid Metallick and Mineral Nodules, or Matter, be chiefly of *one Sort;* or, if of *ſeveral*, what *Proportion* there is of each. Obſerve whether there be any *Trees*, Nuts, Acorns, Fir-Cones, Leaves, or other *vegetable Bodies* lying in the ſaid Strata; or any *Teeth, Bones, Horns, Hoofs*, or other *Parts of Animals* of any Sort; or *Shells* of the *Cruſtaceous Kind*, e. gr. Crabs, Lobſters, *&c.* or of the *teſtaceous*, ſuch as Oyſters, Muſcles, Scallops, Lympets, Perewinkles, or any others whatever. But with more particular Care examin the *Strata that lye deepeſt*, and at or near the *Bottoms* of Pits, Mines, and Quarries, to diſcover whether they contain any *Shells*, or other like extra-

neous Bodies. If the ſaid deeper Strata be of *Stone* or *Marble*, break off Pieces, and *wet* them with *Water*, to waſh off the Duſt or Powder that may cover and obſcure them; then viewing them with great Application, obſerve whether broken Edges or other Parts of Shells do not appear. The Shells, and other extraneous Bodies immers'd in Stone, have oftentimes their Pores ſo ſaturated with the ſame Sort of Sand with that which conſtitutes the Stone; nay, even their Surfaces are ſo ting'd, and frequently ſo much of the ſame Complexion with the Stone, that they are not to be diſcovered without a very nice and careful Examination. Laſtly, Note in what *Numbers* the ſaid *Vegetable and Animal Bodies* are found; in what *Poſture* they lye, and particularly, whether the *flatter* and broader *Shells* (as likewiſe the flat and compreſs'd *Mineral Bodies* of all Sorts) be not repoſited in ſuch Manner, that their *Flatts* are parallel, and conformable to the Surface of the Stratum in which they are encloſed. Enquire whether there are latent in the ſaid Strata,

any

any Flints, Pebles, or other Bodies that reſemble, or have Marks or Impreſſions of Shells, or of Leaves, Teeth, Bones, *&c.* upon them.

V. Obſerve whether each ſingle Stratum of Stone, Marble, or other ſolid Matter be *whole* and *continuous*, or *broken* and divided by Clefts or *Fiſſures*. In caſe they are, take notice, 1°. whether the ſaid Fiſſures ſever, and paſs down thorow only *one*, or *more*, or all the Strata. 2°. Whether they be *perpendicular*, and tend upwards directly towards the Surface of the Earth, or Slant and decline. 3°. Of what *Wideneſs* and Capacity they are. 4°. In what *Number*, and at what *Diſtance* from each other. 5°. Whether the Strata, on one Side the Fiſſure, *anſwer*, tally, and fit thoſe on the oppoſite Side of it.

VI. Examin whether thoſe *Fiſſures* be *empty*, or contain any *Matter* in them. If the later, obſerve, 1°. of *what Sort* it is, whether ſome Kind of *Ore*, e. gr. of Lead, Tin, Iron, Copper, *&c.* or ſome *Mi-*

Mineral, as Sulphur, Mundick, Marcasite, Calamin, Amianthus, Cobalt, Load-Stone, Cinnabar, Antimony, Bismuth, Speltre, or Talc, Spar, Crystall, or whether there be Amethysts, Topazes, Saphires, Emeralds, *&c.* or common Salt, Nitre, Vitriol, Alum, *&c.* 2°. In what *Number* or *Quantity* the said Ores, Minerals, and other Things are found. 3° In what *Order* they are reposited in the Fissures. 4°. In what *Manner* and *Form* they appear; whether they lye only in *rude Masses*, or are disposed and shot into any *observable Figures*, e. gr. Rhombs, Cubes, Pyramids, *&c.* Whether the *Native Metals* be ever found in Threads or Plates or Masses, so *pure* and free from Admixture of other Matter, as to be flexible or *malleable*. And whether any Part of the Metallick or Mineral Matter be formed into *Stalactitæ*, or Bodies resembling *Icicles* hanging down from the Jetts of the Fissures, or vaulted Tops of Grottoes; or cover and *crust over* the Stone at the Bottoms and Sides of them.

VII. Ob-

VII. OBSERVE in *what Manner Water* iſſues into Pits, Mines, and Quarries; in what Quantity it enters; at what Time it is moſt plentiful; whether it be *pure* and taſteleſs, or *tinctured* with Salt, Nitre, Alum, Vitriol, or ſome Kind of Mineral.

VIII. ENQUIRE, whether any Guſts of *Wind* be ever obſerved in the ſaid Pits or Mines, or any Sorts of *Damps*, or *Steams*; what are the *Signs* or preſages, and what the *Conſequences* and *Effects* of them; at what *Seaſons*, and in what Sort of *Weather* they are chiefly obſerved; what *Temperature* the Air bears, as to *Heat and Cold*, in Pits or Mines; and whether it be conſtant or changeable; in caſe the later, Information ſhould be got at what *Seaſons*, and upon what *Occaſions* thoſe Changes happen; as alſo, whether there ever be obſerved any *Steams*, *Damps*, unuſual *Heat* or *Cold*, or any other remarkable Accident in the *Bottoms* of Mines, Pits, or Quarries, a little before, or during the Time of *Rain*, Hail,

Hail, Wind, Storms, Thunder, or other extraordinary *Weather* in the Air above. [See the Appendix infra.]

This is the fitteſt Conduct and Procedure I can pitch upon for their Obſervations and Enquiries; and what Intelligence and Information is gain'd by them may be enter'd into the *Regiſter* in the very *Method* it muſt needs ariſe by the Regulation of the Courſe of the Obſervations according to the foregoing Directions, or as near as conveniently may be. To which Purpoſe that Regiſter ought always to be *ready* at Hand on theſe Occaſions; and the Obſervations entred upon the *Place*, for fear of Miſtakes, or Failure of Memory. At leaſt, *Notes* ought to be taken upon the Spot, and they to be entered into the Regiſter as *ſoon* as may be, and while all is freſh in Mind. In the tranſacting of this whole Matter, great *Truth* and *Faithfulneſs*, as well as *Exactneſs* and *Care*, ought to be uſed; a Failure in either, tho' very ſmall, leading oftentimes into conſiderable Errors.

The Inſtances here pointed forth, and the Phænomena to be obſerved, are very *numerous*; and 'tis not to be expected, that near ſo many can ever occur in *any one Pit* or Mine. Or if they do, there are few Perſons that have the *Leiſure*, or perhaps the *Curioſity* to attend to all of them. In which Caſe 'tis only deſired that thoſe *Inſtances* that do occur in any Place, whether they be more or fewer, be noted; and ſuch *obſervable Bodies*, as appear, be collected. And for thoſe who cannot beſtow much, may at leaſt employ ſome Time in theſe Searches; which, if they do, and are but Maſters of *Judgment* and *Thought* enough to make the Uſe of them, that they may eaſily do, they can never have Cauſe to think that Time miſpent. For *theſe Inquiries* tend not only to the promoting of *ſecular Profit* and *Advantage*: But, which is not leſs conſiderable, carry the *Mind* of Man into a Field of *Knowledge* that is extenſive, entertaining, and inſtructive, hardly to be expreſs'd by Words.

But there are ſome of the Obſervations that cannot well be made by any but the very *Perſons employ'd* in *Digging* and *Mining*. The *Adits* and *Shafts* of Mines are uſually fenced and *covered* with Timber to ſecure the Earth from falling in; ſo that the Strata of thoſe Shafts by that Means being concealed and ſcreen'd from View, an Account of them can be had only from the *Miners*, and thoſe who ſunk them. But then the Strata at the *Bottom* of thoſe Mines lye fair and open for Obſervation, and may be viewed oftentimes to a very great *Extent*. Again, there are other Things that require *Time*, and ſome conſiderable *Abode* in the Mines, Pits, or Quarries, to come to due Knowledge and Information of them. Such are *Winds*, *Damps*, and *Exhalations* in the Bowels of the Earth; the *Viciſſitudes* and *Seaſons* of them; the various *Temperature*, Heat and Cold of the Air underground, at *different Times*, and the like. Theſe muſt be learned of the *Miners* and *Workmen*; and they may be likewiſe conferr'd with

with about thoſe Things that are *more obvious*, and liable to Obſervation. But particular *Care* ought to be had not to conſult or take Relations from any but thoſe who appear to have been both *long converſant* in theſe *Affairs*, and likewiſe Perſons of *Sobriety*, Faithfulneſs and *Diſcretion*, to avoid the being miſled and impoſed upon either by *Falſhood*, or the Ignorance, *Credulity*, and *Fancifulneſs*, that ſome of theſe People are but too obnoxious unto. And, after all, there ought to be a *Diſtinction* made in the Regiſter betwixt thoſe Obſervations *perſonally* made, and thoſe that are *communicated* by the *Miners*.

APPENDIX I.

Concerning Mines.

ENQUIRE of the Miners, 1°. Whether they have ever met with any Evidences of the *Growth* of any Metall or Mineral; and whether after a Stratum, Vein or Fiſſure, is once cleared, and the

Ore intirely taken forth, they ever after find any, either of the ſame, or any other Sort, in that very Stratum or Vein.

II. WHAT *Signs* in the Earth or Water, the Miners conduct themſelves by in their Working and Searches after latent Metalls and Minerals.

III. WHETHER there be any Thing particular and obſervable in the *Inſtruments*, or in the *Methods* they make uſe of in *mining*.

IV. WHETHER they uſe any Sort of *Flux* in their *ſmelting Works*, beſides *Slagg* or *Cinders*; or there be any Thing uncommon, and peculiar in the *Structure* and *Contrivance* of thoſe *Works*.

V. WHETHER there be any particular and extraordinary mechanical *Inſtruments* or *Artifices* made uſe of in their *Forges* or Furnaces.

VI. WHETHER the Perſons that frequent and work in the Mines be ſenſibly injured

injured in their *Health*, by poiſonous or unwholſome Steams ariſing thence: Or the Air, Water, Herbs, or Fruits near the Furnaces or Forges, be *noxious* or offenſive to Men or Cattle.

APPENDIX. II.

Relating to ſuch Fens, Boggs, *or* Marſhes, *in which the Peats or* Turffs *uſed for* Fuel *are got.*

1. OBSERVE their *Place* and *Site*, whether in a Valley, on a Plain, or an Hill.

2. THE *Bounds* and *Extent* of them; and whether there be not Tracts of *Sand* or *Earth* of a Nature different from that of the *Turff-Earth* interpoſed amidſt it.

3. EXAMIN what is the *Thickneſs* of the Stratum of the Turff-Earth; and whether it be of the ſame Thickneſs in all Parts of it.

4. WHAT

4. WHAT *Sort of Earth*, Sand, or other Matter lies at the *Bottom* underneath the Turff-Earth.

5. WHAT are the Properties, *Nature* and Conſtitution of this Earth; and whether it be all of the ſame, or of different *Sorts*.

6. ENQUIRE whether the Turff-Earth grow; or, what Evidences there are, that when it, or any Part of it, is cut and digg'd up, 'tis in Tract of Time repair'd and ſupply'd afreſh.

7. WHAT *Springs*, or other Receptacles of Water there are in theſe Marſhes.

8. WHETHER there be any Bones, Teeth, Shells, or other *Animal Subſtances* found lodged in this Earth; and at what *Depth*, in what *Manner*, and in what *Numbers* they are found.

9. WHE-

9. WHETHER any Trees, Shrubs, Herbs; Fir-Cones, Nuts, Acorns, or any other *vegetable Bodies*. Of what *Kinds* they are, and whether there be of the ſame Kinds of Trees, Shrubs, *&c. now growing* in or near thoſe Marſhes; at what *Depth* they are found, of what Bigneſs, and in what *Numbers*. In what *Poſture* the Trees lye, in what Condition they are found as to Firmneſs and Soundneſs: Whether the Roots be found yet adhering to the Stump of the Tree, the *Trunk* or Body being ſever'd off from it: Whether, if ſo found, the Stump be in a *growing Poſture*, ſtanding up above the Roots, or it be alſo ſometimes *reverſed*, and turned topſy turvy, with the *Stump downwards*, and under the Roots: Whether *one Stump* with the Roots be not ſometimes found placed directly *over another*, or in ſome *other Poſture*, wherein both could not naturally have grown: Whether in any Marſh there be found *only the Roots*, without the *Trunks* of the Trees, or the Trunks *alone*, but *no Roots*: Whether either Trunks, or Roots, when

when firſt taken forth of the Earth, have any *Marks* or *Signs* of human *Workmanſhip* upon them, appearing to be cut with an *Ax*, or *Saw*, or there be any *Cinders*, or other Evidence of Fire, evincing that Part of them hath been *burnt*.

10. By what *Means* do theſe Trees, and other Bodies ſeem to have been *repoſited* in that Manner; and what are the *Opinions* of the Perſons employ'd in digging the Peats, and of the near *Inhabitants* concerning them.

APPENDIX III.

Of Mountains, Rocks, and Cliffs.

1. OBSERVE the *Bigneſs* and *Height* of the Mountain; what Grottoes are in it; what *Springs* ariſe upon it, and in what *Part* of it they are; as alſo, what *Rivers* or running Waters have their Sources in it; and what Quantity

tity of Water they discharge Summer and Winter.

2. If by Means of any *Fall of Earth* from it, the Mountain, Rock, or Cliff be laid *bare*, and its Strata exposed to View, or by the repeated *Battery* of *Rains*, or the Violence of the *Sea*, digging for Stone, Marble, or the like, observe, 1. the *Posture* of the Strata, whether *Horizontal*, *inclining*, or *erect*; also their *Thickness*, *Consistence*, and *Fissures*. 2. The several *Sorts* of *terrestrial Matter* of which each consists, recounting them in the *Order* they lye. 3. What *Metallick* or *Mineral* Matter they contain. 4. What *Shells*, *Teeth*, or other *extraneous Bodies*.

3. Search carefully in all Places for *Shells*, and other *Marine Bodies*; but more especially at and near the *Tops* and *highest Parts* of Rocks and Mountains.

4. Enquire whether the *Tops* of the higher Mountains and Rocks do not emit *Vapours* in great Plenty, or there

be not a *Cloud* hovering upon them before, or during the Time of *Rain, Hail, Snow, Wind, Storms, Thunder,* or other tempeſtuous *Weather:* Whether from the Manner, Colour, Bigneſs, Duration of the Cloud or Vapours, any *Preſage* may be made *what ſort* of Weather, e. gr. whether Wind or Rain will enſue; or of *what Continuance* it will be; whether the ſaid Cloud or Vapours appear upon Change of Weather *conſtantly*, or only at *ſome Times*. 'Twere much to be deſir'd, that ſome *Perſon* living in View of ſuch Mountains, would keep a *daily Regiſter* of the *Weather*, and at the ſame Time of all the *Phænomena* of the ſaid Cloud or Vapour; and if he be in View of two or more ſuch Mountains, at once, that he extend his Obſervations to all of them.

5. WHETHER ever there be any extraordinary *Eruptions* or *Diſcharges* of *Water* in conſiderable Quantity, out of thoſe Mountains.

APPEN-

APPENDIX *to Page* 107 *ſupra, containing more full, explicit and particular Inſtructions for making Obſervations concerning Fogs, Miſts, or Clouds, ſeen frequently upon the Tops of high Hills or Mountains.*

1. OBSERVE whether theſe Fogs ariſe out of the Hill; or whence otherwiſe do the Vapours that conſtitute them proceed.

2. WHETHER they be ſeen hovering over the Top of one only Hill, or of more.

3. WHETHER the Fog on the ſeveral Hills firſt appear at the ſame Time on each, increaſe in equal Proportion on all, and decreaſe likewiſe on each at the ſame Time.

4. WHETHER theſe Fogs be conſtant Forerunners of Rain; ſo that it never happens either in Summer or Winter, unleſs they appear before; and whether Rain always follows whenever ſuch Fogs appear.

5. OBSERVE how long they appear before the Rain falls.

6. WHETHER any Judgment can be made by View and Obſervation of theſe Fogs, of the Quantity or Duration of the Rain; or whether it will be attended with Storms of Wind, or by Thunder and Lightning.

7. WHETHER the Rains that fall, ſeem to proceed from the Fog gradually diffuſing it ſelf, and overſpreading the Country.

8. WHETHER the Barometer conſtantly fall at ſuch Time as the Fog riſes, and in Proportion to the Quantity of it, and riſe

riſe again at ſuch Time as the Fog is diſperſed and withdrawn.

APPENDIX *to Page* 101 *ſupra, containing more particular Inſtructions for making Obſervations concerning Præſages of Rain in deep Mines, great Quarries or Coal-Pits.*

1. OBSERVE whether Wind, Rain, Thunder or Lightning can be foretold before they happen, by any Vapours, Steams, or Exhalations in the Mines, Quarries, or Pits.

2. WHETHER it can be diſtinguiſhed by the Manner, Colour, or Conſtitution of the Vapour that ſhall enſue, whether Rain, Wind, or Thunder.

3. WHETHER Judgment can be made of the Quantity and Duration of the Rain or Wind, by the Thickneſs of the Vapour,

Vapour, the Continuance of it, or any other Way.

4. WHETHER the Vapour conſiſts ſimply of Humidity; or is alſo charged with metallick or mineral Steams.

5. WHETHER Rain conſtantly enſues as often as theſe Vapours diſcover themſelves in the Mines, and the Vapours conſtantly forerun and appear before Rains.

6. OBSERVE how long the Vapours diſcover themſelves before the Rain falls.

7. WHETHER theſe Vapours be obſerved only in ſome, or in all Mines indifferently; and whether they riſe at the ſame Time in all, ſo far as Intelligence can be obtain'd.

8. WHETHER they are attended with any unuſual Heat.

9. OBSERVE wherein theſe Steams differ from thoſe called Damps; or whether

ther Damps greater or leſs, and Rain, conſtantly attend each other.

10. OBSERVE how the Barometer and Thermometer, as well thoſe kept in the Mines, as thoſe above Ground, are affected during the Aſcent of the Steams and Damps, and during Rain; as alſo before and after.

NUMBER IX.

An Addition *to the ſecond Part of the* Eſſay towards a Natural Hiſtory of the Earth.

THE *Conſectaries* of the *former Part* of this *Diſcourſe* are all *negative; that* being only introductory, and ſerving but to free the Way to this *ſecond Part*; to reſcue the Enquiry from the *Perplexities* that ſome *Undertakers* have *incumber'd* it withal; and to ſet aſide the falſe *Lights* they uſed in Queſt of the *Agent* which tranſpoſed theſe *Sea-Shells* to *Land.*

Now, the only *ſure Lights* we have to conduct us in the *aſcertaining* this Affair, are Hiſtory of Fact, and *Obſervations.* So that I ſhall give here ſome Intimation of the *Chief* of *thoſe* that ſerve to clear up *this Subject*, and bring the Thing

Thing in Queſtion to a fair *Deciſion*. Theſe are, That the *Earth*, all round the *Globe*, appears, wherever it is laid open, to be *wholly compoſed of Strata*, lying on each other, in Form of ſo many *Sediments* fallen down ſucceſſively from *Water*. That, accordingly, thoſe *Strata* that lye *deepeſt*, are ordinarily the *thickeſt*: and thoſe that lye *above*, gradually *thinner*, quite up to the Surface. That there are *Sea-Shells*, and *Teeth* and *Bones of Fiſhes*, found *repoſited* in theſe ſeveral *Strata*; not only in the more lax, *Chalk*, *Clay*, and *Marle*, but even the moſt ſolid *Stone*, and the reſt. That theſe *marine Bodies* are *incorporated* with the *Sand* that conſtitutes the *Stone* of theſe *Strata*, in ſuch Sort as together to *compoſe one common Maſs*. That on breaking up this Maſs, ſo as to part the *Shell* from the *Stone*, *this* is ever obſerv'd to have receiv'd an *Impreſſion* of the *exterior Surface* of the *Shell*, ſo exact as to ſhew it had been *contiguous* and *apply'd* to *all Parts* of the *Shell*; which the *Stone could* not be capable of, had it not been then in a *State of Solution*, the

Matter whereof it consists *loose*, and susceptible of *Impression*. That, upon breaking the *Shells*, and examining the *Insides* of them, they are found to contain in them *Stone*, commonly of the same Kind with that without, which the *Stratum* is made up of, and *apply'd* as exactly to the *Insides* of the *Shells*; so as to have taken the *Impression*, and all the *Lineaments* of them, after the Manner of Matter *cast*, soft, or melted in a *Mould*. That the *Shells* are as frequently *immers'd* in the *Substance* of the *Mineral* and *Metallic Nodules*, even the most firm and solid, *Flint*, *Spar*, *Pyritæ*, and the rest; the Matter of these *Nodules* exhibiting the *Lineaments* and *Impressions* of both the *Outsides* and *Insides* of the *Shells*, as truly as the *Stony Matter* of the *Strata* does. That these *Marine Productions* are thus *reposited* as well in the *lowest Strata*, as in the *uppermost*; at the *Bottoms* of the *deepest Mines*, as to the very *Tops* of the *highest Mountains*. That they are observ'd in some Places in such *Multitudes*, as in Bulk and Quantity, to *equal*, if not *exceed* the

Sand, or other *terreſtrial Matter* of the *Strata* That there are ordinarily digg'd up, amongſt the reſt, *Shells* that are of *foreign Origin* and *Extract*; being *not the Product* of the *Neighbouring Seas*, but of *Seas* much *remote*, and at great *Diſtance*. Thus we here *in England* diſcover, frequently at great *Depths*, *Shells* of Fiſh, very numerous, and of different Kinds, that appear now living on the Coaſts of *Peru*, and other Parts of *America*. That there are likewiſe *diſcover'd* commonly at Land, and in the Bowels of the Earth, *Shells* that are not at this Day found *living* on any *Coaſts*; being doubtleſs ſuch as naturally reſide and inhabit only in the *deepeſt* and moſt remote *Receſſes* of the *Main Ocean*, without ever now approaching near any Shore, or being conſequently ever ſeen. That, in *all Parts* of the *Earth*, as well in *Aſia*, *Africa*, and *America*, as in *Europe*, as well in *Countries* the moſt *Diſtant* from any *Seas*, as thoſe that lye *near* to them, the *Strata* are compil'd, and the *Marine Bodies* diſpos'd in them, every where after the very *ſame Method*;

and ſo, as apparently to ſhew *Things* were reduced into this *Method* in *all Countries*, at the *ſame Time*, and by the *ſame Means*. That there are alſo lodg'd in the *Strata*, *Bones*, *Teeth*, and other Parts of *Quadrupedes*, or *Land Animals*, and oftentimes of ſuch as are *not Natives* of the *Country* in which they are thus found. Particularly here in *England* we dig up the *Tusks*, and the *Grinder-Teeth*, the *Bones*, yea, whole *Skeletons* of very great *Elephants*; and likewiſe incredible large *Horns* of the *Mooſe Deer*, a Creature not known to be *now living* in any other Country excepting *America*: As alſo, ſometimes Shells of *Tortoiſes*, peculiar to the ſame Country. That there are beſides, repoſited in *Stone*, and even in the firmeſt and hardeſt *Strata*, Leaves of various Kinds of *Vegetables*: and ſometimes whole *Trees*; as alſo ſuch *Fruits* as are durable, firm, and capable of being preſerv'd, *e. gr. Nuts*, *Pine-Cones*, and the like. That, amongſt the reſt, there are diſcover'd, under Ground, *Trees*, *Leaves*, and *Fruits* of *Vegetables*, in *Countries* where ſuch do not

not now ſpontaneouſly *grow*. Nay, that there are digg'd up *Trees* in great *Numbers*, and many of them very *large* in ſome *Northern Iſlands*, in which there are at this Day *growing* no *Trees* at all; and where, by reaſon of the great *Bleakneſs* and *Cold* of thoſe *Countries*, 'tis probable none ever did, or could grow. That, of all the various *Leaves* which I have yet ſeen thus lodg'd in *Stone*, I have obſerv'd none in any other State, nor Fruits further advanc'd in *Growth*, and towards *Maturity*, than they are wont to be at the latter End of the *Spring Seaſon* *. That the ſquamoſe Covers of the *Germina* or Buds, and the Shives or Chaff of the *Juli Trees* and *Shrubs*, that fall off in the Spring, and are found in ſo vaſt Quantities in many Peat-Marſhes, apparently point forth the *ſame Seaſon*. As do likewiſe the immenſe Sholes of the *Ova* of *Fiſhes*, ſo frequent in

* *When*, according to the *Moſaic Relation*, the *Water* of the *Deluge* came forth, and put a *Stop* to the *Growth* of both *Animals* and *Vegetables*. *Confer Part* 3. *Sect.* 2. *Conſ.* 5. and *Part* 6. towards the End.

in the upper *Strata* of *Stone*. That the *Shells* of the *Young* of *Fish* of the *current Year*, wherever digg'd up, are of the *Size* and *Bigness* they are used to arrive to at *that Season*. That of all the many *Flies* and *Insects*, that I have yet seen inclos'd in *Amber*, I have never observ'd any that were not of the *vernal Tribes* and *Kinds*.

THESE are the main *Observations* whereon I ground what I *offer* in this second Part of the *Essay towards a Natural History of the Earth*.

A Mine-

A

Mineral Dictionary;

OR

An alphabetical

INDEX

Of the Names of all Kinds of Foſſils, referring to the Pages of this Work, wherein each is explain'd.

INDEX of Things occaſionally *treated of in theſe Papers.*

FINIS.

JO. *Raii* Synopsis Methodica Stirpium Britannicarum tum Indigenis tum in agris cultis locis suis dispositis, additis generum characteristicis, specierum descriptionibus & Virium Epitome. Editio 3*tia* multis locis Emendata & 450 circiter speciebus noviter detectis aucta, cum Iconibus. 8°.

——Synopsis Method. Avium & Piscium cum fig. 8°.

——Synopsis Method. Animalium Quadrupedum & Serpentini Generis. 8°.

——Methodus Insectorum.

A Natural History of English Insects, with 100 Copper-plates coloured after the Life, by *E. Albin*, to which are added large Notes, and many curious Observations by *W. Derham* F. R. S. 4°.

Physico-Theology, or a Demonstration of the Being and Attributes of God from a Survey of the Creation. By *W. Derham*. The 6th Edition, 8°.

Three Physico-Theological Discourses concerning,

I. The primitive Chaos and Creation of the World.

II. The general Deluge, its Causes and Effects.

III. The Dissolution of the World, and future Conflagration, wherein are largely discuss'd the Production and Use of Mountains, the Original of Fountains, of formed Stones, and Sea Fishes, Bones and Shells found in the Earth, *&c.* By *John Ray*, late Fellow of the Royal Society. The 4th Edition, 8°. with Copper Plates.

Cyclopædia, or an universal Dictionary of Arts and Sciences, containing the Definitions of the Terms and Accounts of the Things signify'd thereby in the several Arts both Liberal and Mechanical, and the several Sciences Human and Divine: The Figures, Kinds, Properties, Productions, Preparations and Uses of Things natural and artificial: The Rise, Progress and State of Things Ecclesiastical, Civil and Commercial, with the several Systems, Sects, Opinions, *&c.* among Philosophers, Divines, Mathematicians, Physicians, Antiquaries, Criticks, *&c.* The whole intended as a Course of Antient and Modern Learning, compiled from the best Authors, Dictionaries, Journals, Memoirs, Transactions, Ephemerides, *&c.* in several Languages, in 2 Volumes. By *E. Chambers* Gent.